

POPULAR SCIENCE

OCTOBER

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See Page 53

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PAUL
37

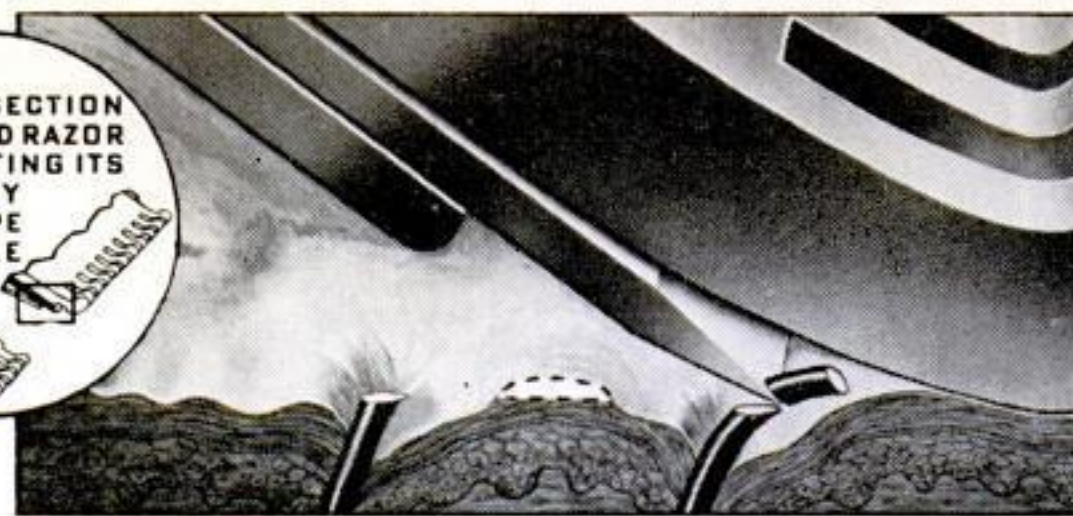
NEW INVENTIONS • MECHANICS • MONEY MAKING IDEAS
HOME WORKSHOP PLANS AND HINTS • 350 PICTURES

Science looks at...whiskers

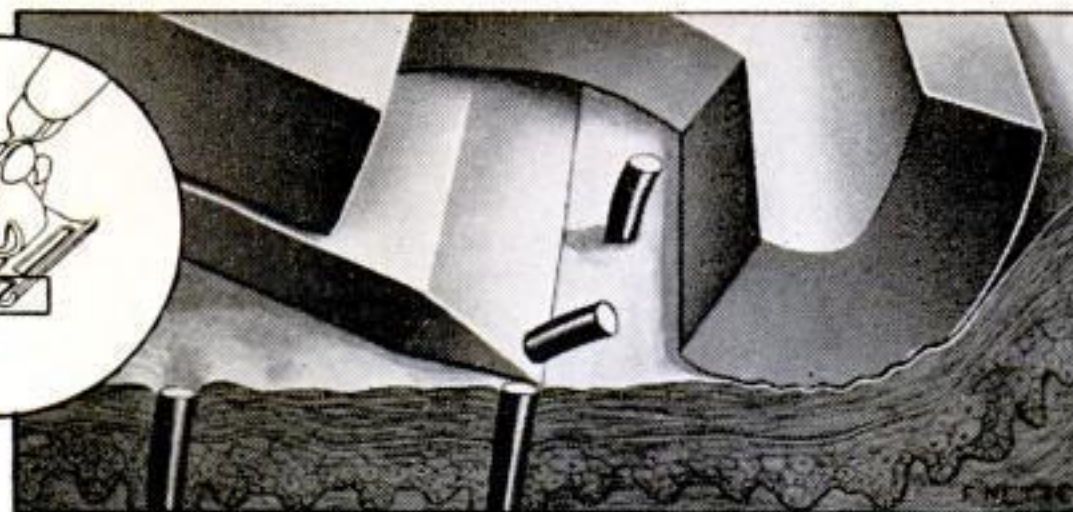
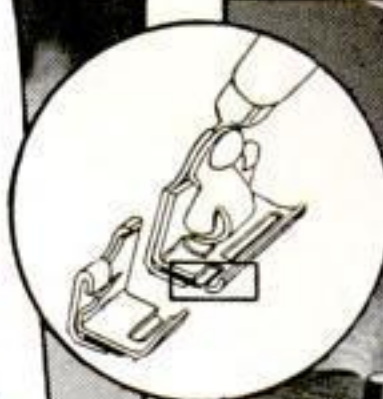
Every day of his life, man must shave. It takes time, it causes him trouble, it costs him money. Yet how much does man actually know about it? "Practically nothing," declared one of America's greatest independent research institutes about five years ago, and so went to work to get some really scientific knowledge about removing whiskers. This is No. 1 of a series, based on the findings of that five-year study.

SHAVING A HAIR SHAFT would be far simpler but for two complications. First, the whisker is set in a *yielding* rather than rigid base. The skin, like soft rubber, lets the whisker bend over when the blade strikes it, making a difficult cutting angle. Second complication is irregularity of the skin surface. Tiny microscopic ridges and furrows cover the face, and the whisker itself grows in a slight "pit." Problem is to cut the whisker cleanly at, or below, actual skin line, without nicking tops of the mound which rise around it.

CROSS-SECTION OF FOUR OLD RAZOR ILLUSTRATING ITS ORDINARY TOOTH TYPE PRINCIPLE



HERE, GREATLY ENLARGED, is a side view of the tooth-type razor cutting a whisker. Its combing "teeth" (see circle) are not so designed as to stretch the skin taut enough to hold the whisker firm; it bends over as the blade cuts through it. This operation "pulled," did not feel comfortable to the shaver . . . left a long-pointed stub which his wife will complain of before the day is over. Notice (dotted lines) how the top of a ridge was nicked by the blade. Hardly visible to the naked eye, such nicks are nevertheless painful, cause "smarting" feeling you have after a bad shave.



THIS, SAYS THE INSTITUTE, is a close, comfortable shave. The razor: a Schick Injector, which the five-year research helped to perfect. Its chief advantage (in this particular problem) over the razor above is the "Guide Bar." Its surface is *flat*—not comb-like—has a slight "tread" which grips the skin, stretches it taut ahead of the blade. Notice how the whisker, held firm by the taut skin, did not bend from pressure of the blade . . . was cut off evenly with no long-pointed stubble to show or be felt. Notice, too, how the tiny ridges and furrows are pulled out flat and smooth, out of the way of the blade edge. They didn't get nicked, there is no "smarting" afterward.

NO SLEIGHT OF HAND THIS . . . merely the quick, convenient way blades are changed in the Schick Injector Razor. Blades are sealed in a coating of oil in a metal Injector. A mere pull and push of a trigger shoots the old blade out, a fresh one in. Nothing to unwrap, take apart, twist or unscrew. Handy!

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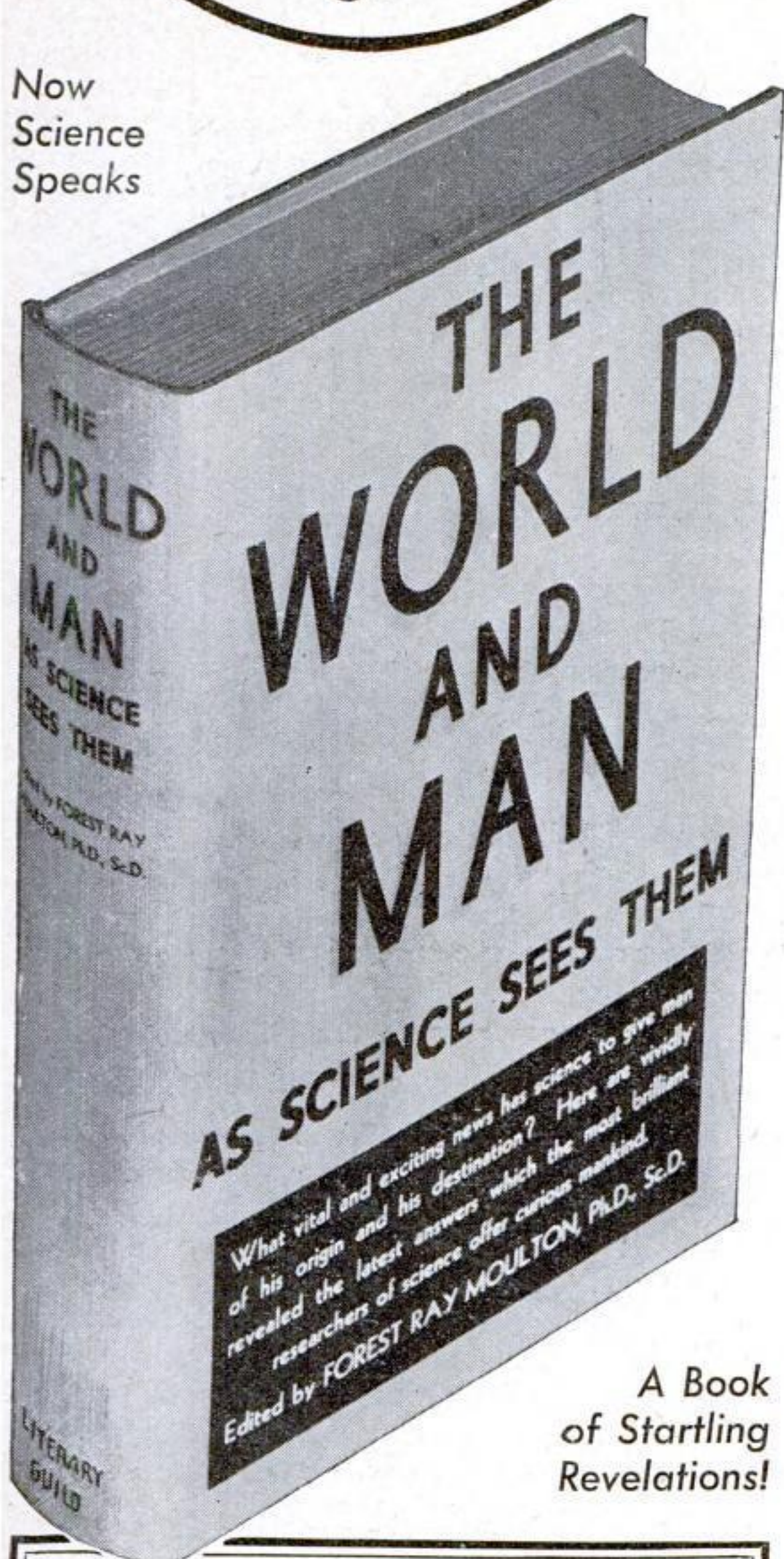
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Where did the earth come from?
Do you know that the ocean moving in terminated the formation of coal—forty times in Ohio and more than one hundred times in Wales?
What is heat?
What is electricity?
Why does bone stop x-rays?
What is "heavy" water and what would happen to you if you drank it?
Can sound be bent?
Why do some chemicals mingle with no effect on each other while others explode violently when they are mixed?
What is LIFE?
Exactly what happens in reproduction?
Where and how did life originate?

What gives plants and flowers their color?
What have man, lizard, crow and codfish in common?
What birds can't fly?
Where did teeth come from?
Where did eyes come from?
Do you know that the first "horses" were about the size of a fox-terrier?
What are vitamins? Which ones do we need? How do we get them?
Do glands "think"?
What happens in your body when you feel pain? When you itch?
What is SLEEP?
Is acid-stomach dangerous?
Does fasting cure disease?

THE WORLD AND MAN

Edited by **FOREST RAY MOULTON**

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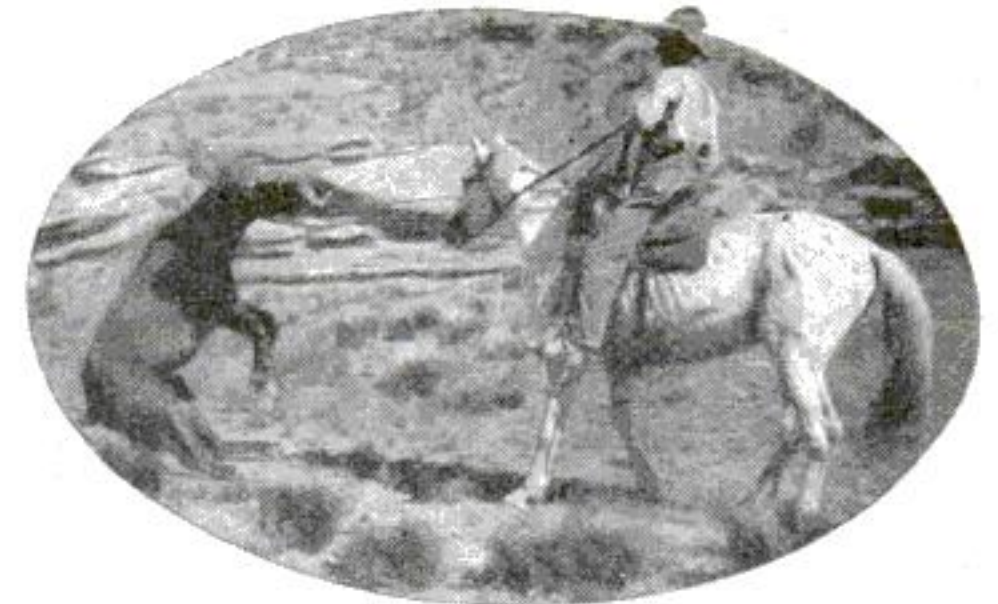
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Our Readers Say



A Photographer's Problem, Using Old Film Spools

YOUR September issue described many interesting uses for old camera films. Fortunately, I don't have so many unsuccessful shots that it is a problem to dispose of the excess celluloid, but what I am interested in is a way of using the empty spools. I have an accumulation of about a hundred old film spools in the different sizes I use, and would appreciate a way of making use of them. Another problem that besets me as an amateur photographer, although it is not so serious, is that of using empty metal film packs. I do use the sheet metal for various model-making purposes, but the supply far exceeds the demand.—B.H.E., Providence, R. I.

ASSISTANCE!



Some Gasoline Motors Are Oil Burners, Too

ONE hears a good deal about the Diesel engine as the coming form of motive power for automobiles but I am inclined to doubt that this type of engine will ever become as universal as those that run on gasoline. In the first place, the fuel is not much cheaper than gas, after taxes have been deducted from the price of the latter—and our alert legislators will be quick to slap a tax on Diesel fuel the moment an automobile manufacturer puts out an oil-burning car. A second objection, even more serious, I think, is the dirt and smell that the oil engine makes. I had to follow a Diesel-driven truck for several miles on a winding road the other day, and the fumes almost stifled me. Our busy roads would be absolutely unbearable if all cars used oil fuel instead of gasoline. This would be a big price to pay for the slightly greater efficiency of the Diesel engine.—T.H.O., Louisville, Ky.

He's Waited a Long Time For Article on Clocks

SOME time ago a reader asked for information on clock and watch repairing. When I read his letter, I was sure that you would respond with an article in a later issue. So far, though, I haven't seen anything on this subject, so I am writing to repeat the other reader's request. In addition, I would like to see plans for a homemade clock; one that has a striking mechanism. This would be a better project than the average sewing cabinet or end table, don't you think? I hope other readers will agree with me.—R.F.O., Russelsheim, Germany.

MAYBE I TOOK IT
APART TOO SOON!



Our Mechanical Smoker Worked Fine on Cigars

BECAUSE the chemistry articles are my favorites, I was especially interested in the novel mechanical smoker described in a recent issue. I made one according to the directions given, and was very much pleased with the results. Not satisfied to see it smoke cigarettes, I tried it with a cigar, and it worked fine. Let's have more ingenious chemical apparatus of this kind that can be built up of odds and ends.—M.N., Seattle, Wash.

Says Triangular Mattress Would Please All Sleepers

IT HAS been said that the simplest ideas usually are the most successful, so I am presenting mine. Why not make mattresses thicker at one end than at the other? Some people cannot sleep without a pillow, and others are unable to use a pillow at all, because it makes them uncomfortable and warm. A mattress that sloped from top to bottom would, I think, please both kinds of sleepers. I hope that this letter will give some mattress maker an idea for the advancement of sleeping comfort. This is really an important subject, because we spend a third of our lives in bed.—A.J.D., Newark, N. J.

PHOOEY!



Built Drill-Grinding Jigs, But Didn't Get the Point

A PROBLEM that I've literally spent months trying to solve is the construction of a drill-grinding device for my home workshop. There ought to be some way of mounting a small V-block on pivots near the grinding wheel to make it possible simply to lay a drill in the groove and grind it to a perfect point without further attention. I know that such devices are used in well-equipped machine shops, but those that I have built have all been failures. If any reader has made such a machine that really works, I certainly wish he would let me know. Drills cost money, and I'm tired of spoiling them on sharpening devices of my own design.—T.B.C., Camden, N. J.

Would Take Color Snapshots If We'd Give Him Advice

Now that color films are available in amateur-size rolls, I would like to see an article on color photography in your regular camera series. If you could tell us what pitfalls are to be avoided, and what precautions should be taken, I want to try this new type of film. As it is, I hesitate to spend a dollar or more for a

roll that may turn out to be a "dud" in my inexperienced hands. Color photography has a big future, and I want to get a good start.—G.J.B., Memphis, Tenn.

Crops Grow Without Dirt For Gentlemen Farmers

BEING interested in chemistry, I would like to see you publish some actual constructional information on "dirtless farming," in which plants are grown in weak chemical solutions. If you could tell us how to carry on this kind of plant growing, I believe it would interest many others beside myself.—N.J.R., Pawtucket, R. I.



A Doctor Reveals Location of the Image in a Mirror

TO ENLIGHTEN M.M. of Flint, Mich., as to the location of his image in the mirror, I want to say that it is just as far behind the reflecting surface as he is in front. In fitting eyeglasses, we doctors like to have the patient read a test chart twenty feet away from his eyes, but often this is impossible because of space restrictions. So we reverse the letters on the chart, and put them over the patient's head. A mirror placed ten feet in front of the patient enables him to read the letters just as if they were twenty feet away from him. Therefore, when you stand one foot away from the shaving mirror, M.M., your image is in reality two feet away from your eyes.—P.H., South Whitley, Ind.

Wants Automatic Gas Pedal for Comfort in Driving

WITH makers of automobiles vying for improvements to put on their latest models, let me offer a suggestion: How about a hand throttle with an automatic constant-speed regulator, for touring in open country? Old-fashioned hand throttles were all right on a level road, but it was a nuisance to have to keep adjusting them every time the car started up or down grade. No wonder that nobody thinks of using anything but the foot throttle today. My idea, though, would be to equip the hand throttle with a self-regulating attachment that would automatically feed more gas to the motor when the car was going uphill and cut down on the gas going downhill. (Continued on page 6)

AW, GO HIRE A
CHAUFFEUR!





J. E. SMITH, President, National Radio Institute
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Set Servicing

Spare time set servicing pays many \$5, \$10, \$15 a week extra while learning. Full time servicing pays as much as \$30, \$50, \$75 a week.

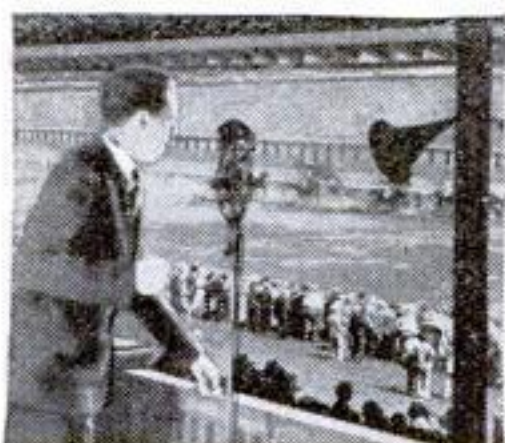
Broadcasting Stations

Employ managers, engineers, operators, installation and maintenance men for fascinating jobs and pay up to \$5,000 a year.



Loud Speaker Systems

Building, installing, servicing and operating public address systems is another growing field for men well trained in Radio.



HERE'S PROOF THAT MY TRAINING PAYS



\$80 Monthly in Spare Time

"I work on Radio part time, still holding my regular job. Since enrolling seven years ago, I have averaged around \$80 every month." JOHN B. MORISSETTE, 809 Valley St., Manchester, N. H.



Makes \$50 to \$60 a Week

"I am making between \$50 and \$60 a week after all expenses are paid, and I am getting all the Radio work I can take care of, thanks to N. R. I." H. W. SPANGLER, 126½ S. Gay St., Knoxville, Tenn.



Operates Public Address System

"I have a position with the Los Angeles Civil Service operating the Public Address System in the City Hall Council. My salary is \$170 a month." R. H. ROOD, R. 136, City Hall, Los Angeles, Calif.



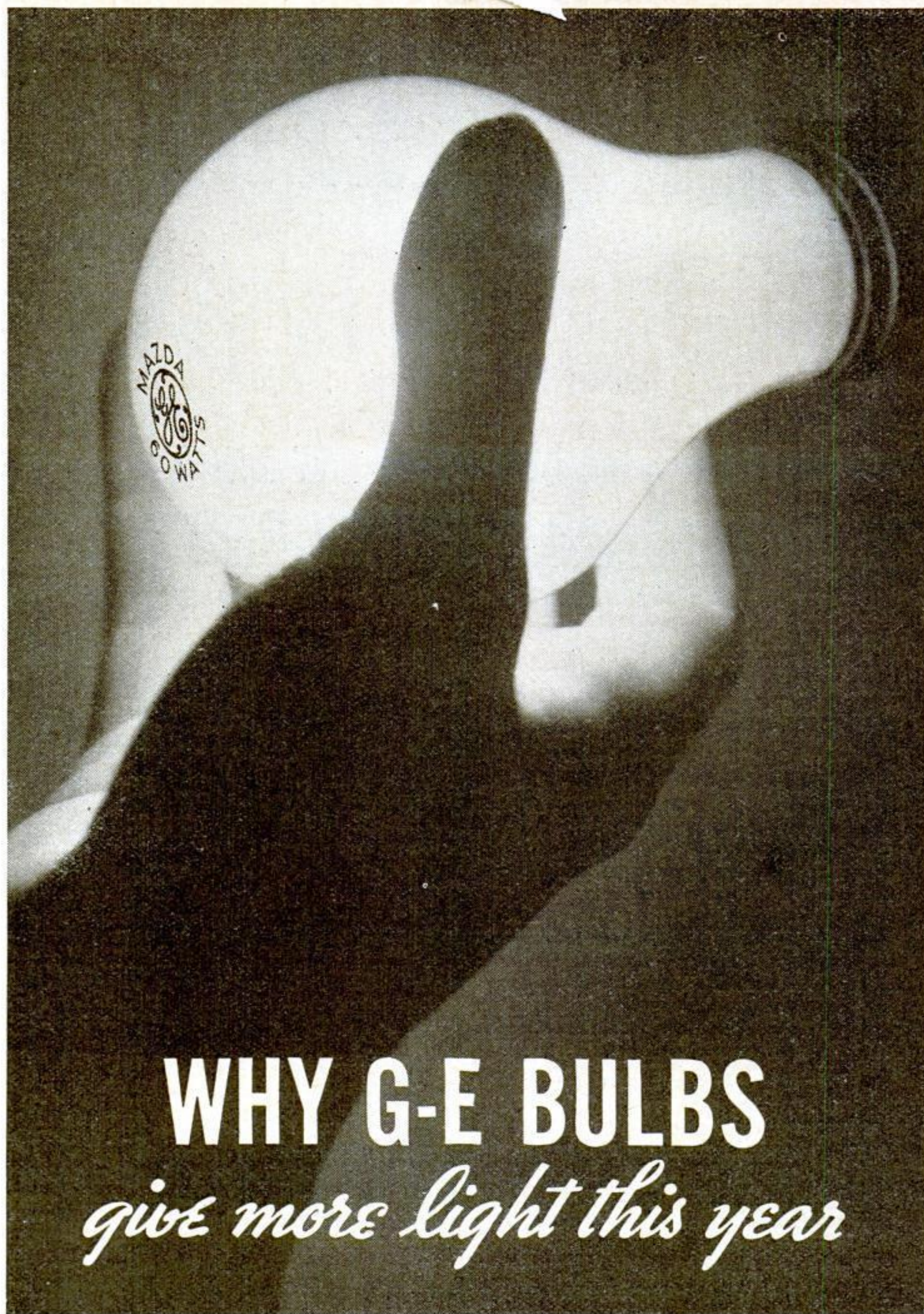
Earnings Tripled By N. R. I. Training

"I have been doing nicely, thanks to N. R. I. Training. My present earnings are about three times what they were before I took the Course. I consider N. R. I. Training the finest in the world." BERNARD COSTA, 201 Kent St., Brooklyn, N. Y.




N. R. I. Training Increases Yearly Salary \$1,200

"Since securing my operator's license through N. R. I. Training, I've been regularly employed and am now with WDOD. My salary has increased \$1,200 in Radio."—JULIUS C. VESSELS, Station WDOD, Chattanooga, Tenn.



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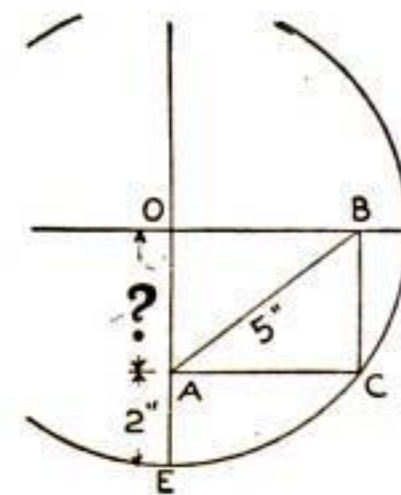
EDISON MAZDA LAMPS
GENERAL  ELECTRIC

(Continued from page 4)

Then with the hand throttle once set at the speed you want, you could lean back and rest your legs while the car kept going at that predetermined speed, regardless of grade (within reasonable limits). The automatic part of the control, it seems to me, would be a simple mechanical problem to work out—perhaps a pendulum of some sort. Of course the driver would take over control with the foot accelerator for handling the car in traffic.—G.P.F., Hartford, Conn.

Puzzle Fans Will Wear Out Pencils on This One

YOUR articles on photography have especially interested me. I'm for more of them. To be specific, I should like to see an article on the reversal process, in connection with motion-picture film or lantern slides. Here's a little teaser for the math sharks. In the diagram, all the intersecting straight lines are at right angles to each other, except the diagonal AB. Line AE is two inches long, and diagonal AB measures five inches. How long is line OA? It's really very simple, but—well, try it!—H.S., Ames, Iowa.



Do You Know How To Read? This Reader Didn't

AFTER I had read your article, "Do you Know How to Read," I couldn't help becoming conscious of the way my eyes jumped from word to word as I glanced at a page. However, I tried following the hints given at the end of your article, and after a little more than a week, I think I've made a definite improvement in my reading efficiency. I would like to see more articles like this, where common acts are analyzed scientifically. How about a story called "Do You Know How To Walk?"—P.F.R., New Haven, Conn.

Dish Washing Is Problem To This Amateur Chemist

ONE thing that would make the chemistry articles more complete is this: why not give us some hints on how to remove stubborn chemical stains from laboratory ware after using the glass tubes and flasks in experiments? I'm sure it would save all of us amateur chemists much time and a good deal of elbow grease.—J.D., University City, Mo.

JUST IMAGINE IT'S A CHEMISTRY PROBLEM!



Heard Music from Stones Half a Century Ago

IN YOUR story on the "Musical Magician" mention was made of the use of stones for producing music. Forty-eight years ago, my home town was visited by a concert company who employed this same principle. A few of their instruments were of standard pattern, but most of the music was produced by a sort of double xylophone that was played by four persons and had tone bars made of stone. The heaviest of these bars

Our Readers Say

was, if I remember correctly, about six inches square and thirty inches long, while the highest note came from a slab about a foot long and three inches square. These stone bars gave out the deepest, richest tones that I have ever heard from any similar instrument. I have a dim recollection that these stones were quarried in Ohio, and that all the stones from that particular quarry were musical when struck.—W.A.M., Elmira, N. Y.

Transparent Mending Tape Saves Silk Stockings

IN A recent issue you described a new desk whose legs had rubber-covered corners designed to protect the silk stockings of women office workers. It may be a long time before such desks come into common use, and meanwhile it will interest thousands of stenographers to know that for a dime they can buy enough transparent-cellulose mending tape to cover all the splintered corners on an ordinary office desk. I hope this suggestion will be useful to some of your readers, because I know that thousands of stockings are ruined each year by rough desk edges.—M.T.C., McMinnville, Oreg.

YES MA'AM, I USED TO MANUFACTURE SILK STOCKINGS!



His Modern Car So Quiet He Hears Every Noise

HERE'S one motorist who welcomes the new flexible rubber strips for making the joints in concrete pavements, as described in your September issue. With my old hard-riding car, I never noticed the little bumps caused by the expansion of the tar joints in cement highways, but with my new bus, the continual bump—bump—bump of the wheels striking the joints is most annoying. Probably my old car made the same noise, but I suppose I couldn't hear it over the other squeaks and rattles that it made. The new car is so darn quiet that every time a bumblebee hits the windshield it sounds like an explosion. I'm hoping that the highway departments of the states in this part of the country adopt the new expansion joint.—F.C.P., Paterson, N. J.

The Solution Is As Complex As the Puzzle Itself

HERE is my solution to the problem about the three men who started from the points of a triangle and met somewhere inside. Assume that one side of the triangle extends east and west, and that the other point is due north. The two-mile-an-hour man, A, starts at the west point, and travels east, nine degrees, fifteen minutes, and twenty two seconds north, 2132 feet. The three-mile-an-hour man, B, starts at the east corner and travels west six degrees, nine minutes, and twenty-two seconds north, 3198 feet. The third man, who travels four miles an hour, starts at the north point, C, and (Continued on page 9)

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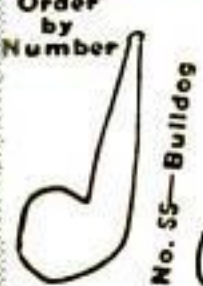
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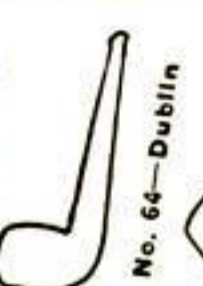
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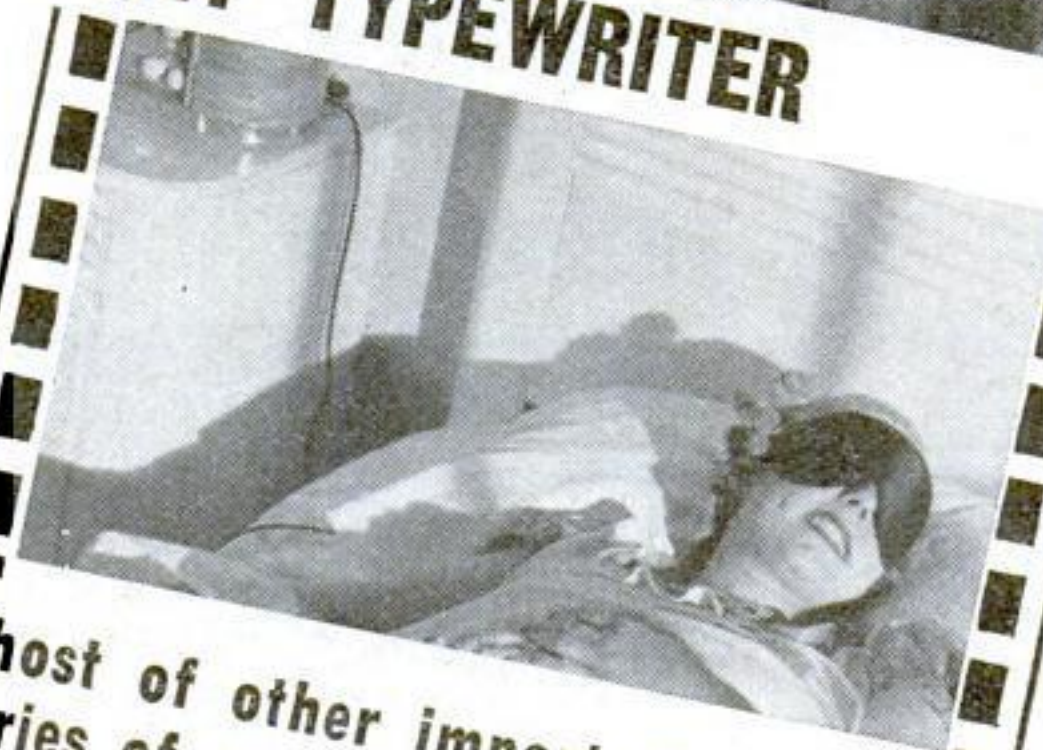
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A Paramount Picture

(Continued from page 7)

travels south, seven degrees, sixteen minutes, and 14.8 seconds west, 4264 feet. The meeting point is 343 feet north of the base line of the triangle.—G.P.F., Portland, Oreg.

Our Articles Too Brief For This Indian Reader

IT GAVE me a good deal of inspiration and encouragement to see a recent letter from another reader, asking for articles on mineralogy. I second the motion, and would like to ask for a bit more. I would suggest that you publish advanced articles on economic geology and human geography. Incidentally, I am sorry to see that over the past six years, since I have been reading Popular Science, your most interesting articles usually are miserably short. I think it would give immense pleasure to the bulk of your readers if you were to increase the length of your leading articles. What do you other readers think?—S.A.R., Peshawar City, India.



Here's Another Good Steer On the Steering Question

THERE'S just one thought I'd like to add to Gus's talk about steering in the last issue. Of course, the veteran mechanic was right when he said that a modern, high-speed car needs a greater gear reduction in the steering apparatus than the old-time autos, but I am inclined to agree with his customer, Tim Grogan. Why don't the automobile companies offer a choice of two steering ratios—a moderate ratio for people like Tim Grogan and myself, who don't like to wind the wheel like a coffee grinder, and an extremely free-turning steering wheel for the ladies? There shouldn't be anything impractical about offering this choice—it could be done simply by changing the effective length of the lever that turns the wheels.—L.A.P., Utica, N. Y.

Gas-Driven Tractor Model Would Be Lots of Fun

YOU have covered almost every branch of model making in the past, but there is one project that I have not yet seen anywhere. Perhaps the idea is entirely new. If so, I want to pass it on to whoever has the skill to design the kind of model I am after, and hope the plans will find their way into your magazine. I have in mind a miniature tractor of the endless-tread type, driven by one of the little gasoline engines sold for use with model airplanes. These midget motors develop quite a respectable amount of power, and if geared down sufficiently they would drive the tractor at a realistic speed, and with power enough to pull the builder all over his back yard. For the endless treads of the tractor, it should be possible to use old automobile timing chains of the "silent" type; they would look realistic and could be obtained cheaply.—I.H.S., Boston, Mass.

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STEP NO. 3

Our complete report of search and opinion on patentability mailed to you.



STEP NO. 4

If you decide to make patent application, drawings and proper papers will be prepared for presentation of your invention to U. S. Patent Office.

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Two prize winning letters in POPULAR SCIENCE MONTHLY'S new Secrets of Success contest—"What Home Study Has Meant to Me"—are printed below. Read these stories carefully because your own career may be just as interesting and inspiring to other readers. If you think so, put it down on paper and send it in. We will pay \$5 for every letter we publish.

CONTEST RULES

Only letters from bonafide home study school students will be considered and these must contain the name of the school and the name of the company, or companies, for whom you have worked since graduation. (Names, however, will be deleted from the letters when published.) We also want to know the kind of course you took and the type of position you have held. Your own identity will be kept anonymous, if desired.

We are interested in facts, not literary ability, but please write clearly, completely, and keep your letters within 750 words. We are not looking for "get-rich-quick" stories or freak adventures, and authors must be prepared to substantiate the truth of the statements. Manuscripts submitted and printed become the property of this magazine, and we are not responsible for the return of rejected stories unless sufficient postage is provided for this purpose. Address your contribution to Success Story, 353 Fourth Avenue, New York, N. Y.

SCHOLARSHIP STUDENT INCREASES HIS EARNING POWER WITH HOME STUDY

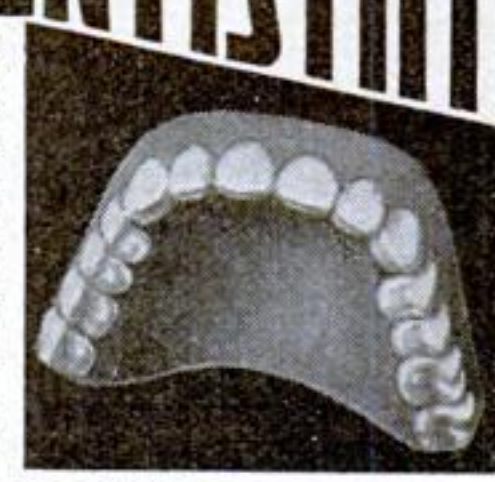
I WAS a scholarship pupil at one of the leading engineering colleges in this country and had completed my first year in Chemical Engineering when sickness and lack of funds forced me to end my college work and seek a means of livelihood.

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Secrets of Success

chased from a defunct chemical company. In three years I had completed the analytical part of my studies and entered the organic section of my course.

Upon completing my work this far I applied for a job with the _____ Company as chemist. In a few weeks I was employed as an analytical chemist at a salary of \$140.00 a month with a paid vacation. Here I found many working who had attended college with me and their jobs were not as good as mine.

The atmosphere of the oil refinery was not conducive to the best health, however, and I again turned to study. The years had taught me that the successful man must know some law.

So this time I enrolled with the _____ University for a course in law. I used all my spare time on the course while I worked in the day, and in three years I was prepared to take the state bar examination. After taking a review at a local law school I applied for permission to take these examinations. They lasted a solid week and I passed with a nice average and in due time was given a certificate to practice law. Many who had attended law schools failed to pass, not because they lack facilities for teaching, but because many college men think education can be put into your head without study.

Upon receiving my law license I left the refinery and became an associate member of a large law firm at a very small salary. That was five years ago and now I have built up a creditable real estate and law business. Recently my law and chemical training has opened up an opportunity in another state I would not have had otherwise.

My chemical training has not been wasted because it taught me much about food chemistry and this knowledge enabled me to regain my health fully.

I cannot praise these courses too highly. To anyone who means business they are the difference between success and failure. True, you must get down and study, but life is like that; the one who risks most gains most. Without my training I suppose I would still be a clerk in a grocery store.

—C. F. W., Lake Placid, Fla.

PUERTO RICAN'S SUCCESS STORY

MY DREAMS were to be a Civil Engineer some time. But in 1918 after completing my first year of high school, on account of the poor condition of my family I had to abandon school and get work to help sustain my brothers and sisters. I obtained work for \$1.00 a day as helper for the mechanics and operators of the sugar evaporators in the sugar mill of the _____ in Carolina, P. R. After two years of work in this mill I had the opportunity of attending a summer course in the University of Puerto Rico to become, on its completion, a rural teacher.



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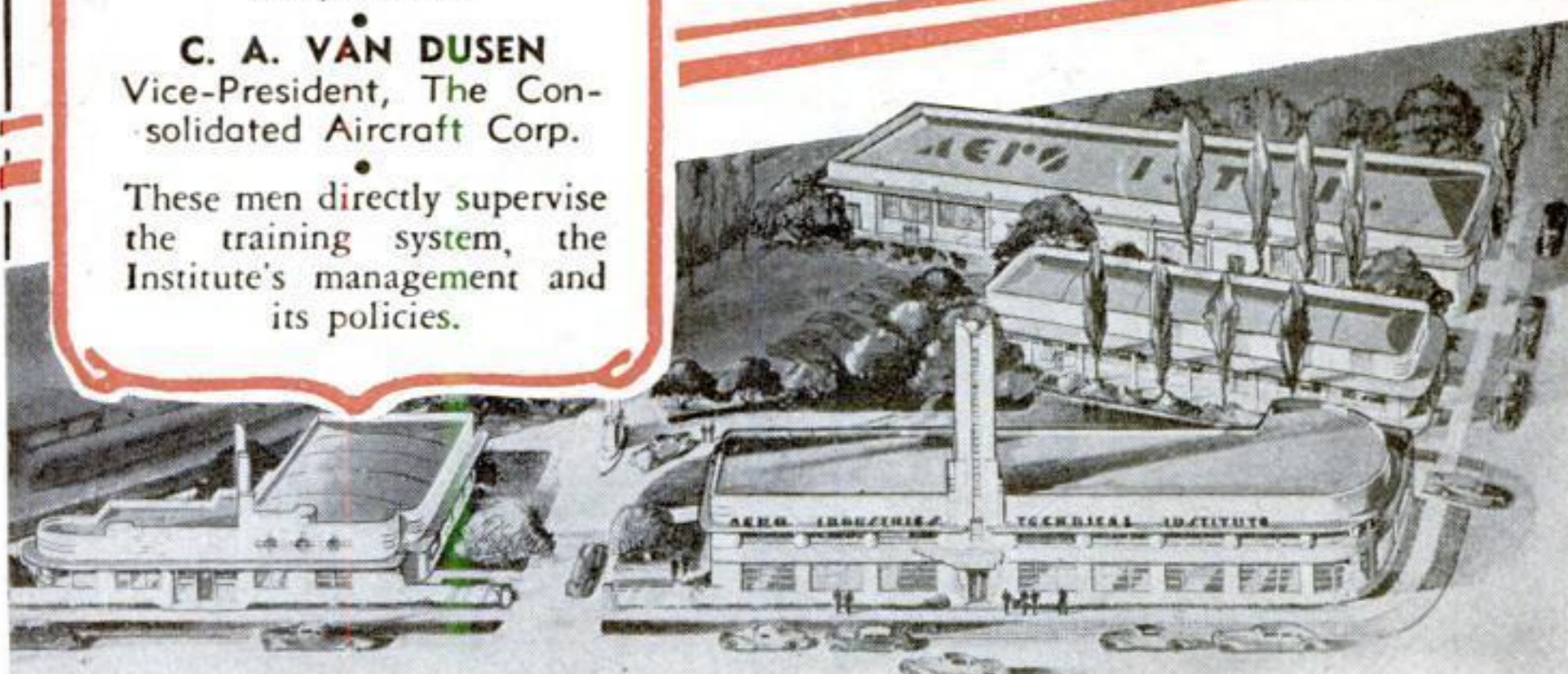
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Secrets of Success

Therefore by the year 1921 I found myself teaching in the countries of the Municipality of Carolina, P. R. with a salary of \$67.00 monthly and paid by the Department of Education of Puerto Rico.

In 1924 I got married and my desires to be a Civil Engineer were greatest for I wished to have a good comfortable home for my wife and family. So in Dec. 1924 I enrolled in the Civil Eng. Course offered for HOME STUDY by the _____ School in Chicago, Illinois.

I studied hard for three years, but the results of my work were soon to be seen. In October 1927 I finished my course and obtained my license to work as Civil Engineer in the Island of Puerto Rico. In the same month of my graduation (if it can be termed such) I got work as Asst. Engineer for field work in the Civil Eng. Dept. of the _____ Company in Loiza, P. R. My salary was \$100.00 a month. Here I worked for two whole years.

During the years 1930 and 1931 (depression days) I engaged in private practice occupying myself in the preparation of the General Plan of the Town of Carolina, P. R., for the Municipal Government of Carolina; Planning of a Drainage Project for Central Jaunita in Bayamon, Puerto Rico; and the preparation of plans for the construction of various frame and reinforced concrete structures for different owners.

In the year 1932 I got employment in the Department of Interior of Puerto Rico as Asst. Party Engineer in the Division of Municipal Roads, with a monthly salary of \$100. The duties of this party were the preparation of the preliminary surveys for future construction of roads. I was on this job until 1933 when I was named Asst. Construction Engineer in charge of the inspection of the construction of Palomas Road in Comerio, Puerto Rico. So I remained until the year 1936, date on which I was promoted to Construction Engineer with a salary of \$183.33 monthly. From that time on I have had under my supervision the following road construction projects: Los Cocos Road in Toa Alta, Puerto Rico; Achiotte Road in Naranjito, P. R., and Valencia-no Road in Juncos, P. R., in which I am actually engaged.

As can be seen clearly, my progress from a helper in a Sugar Factory to Construction Engineer in the Govt. of Puerto Rico is due entirely to the HOME STUDY course I completed in the _____ School. This has enabled me to possess my home, a car, and an 18 acre farm near the town of Carolina, and best of all, to occupy a dignified place in social life.

It is with all my heart that I encourage all fellows unable to attend college or university to enroll in a course with a reputable HOME STUDY school which will lead them to their desired vocation. I have seen some of my friends taking my advice and today they are happy.

—I. E. M., Carolina, Puerto Rico.

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Device Ends Flutter of Airplane Wings

DESTRUCTIVE vibrations set up in the structure of an airplane during power dives are eliminated by a newly patented antifrutter device. The mechanism consists of a flexible arm pivoted by means of a special mounting bracket near the end of a wing tip or other surface where vibration occurs. The far end of this springy arm carries washer-like rings that act as a counterweight, while the inner end is provided with a locking device. Sudden upward or downward pressure on the wing tip causes the lock to hold the inner end of the arm rigid. The outer end, however, remains free, and vibrations set up in the wing structure are neutralized by exactly opposite movements of the weight. Thus dangerous vibrations, known to the aviator as flutter, which are likely to shake a plane to bits during test flights, are counteracted and eliminated before they can do any damage.

Odd Star Speedometer Clocks Meteors

A SPEEDOMETER for meteors that measures the velocity of shooting stars has been developed at the Harvard Observatory in Massachusetts. The instrument consists of a special camera carrying a set of fan blades in front of the lens, arranged so they interrupt the picture twenty times each second. When a meteor flashes in front of the camera, its trail is cut twenty times for each second that it is in the field of view, making the photographic image a set of segments. When these segments are measured, it is possible to compute the speed at which the meteor was traveling.

Chemists Find Secret of Ancient Spring

MODERN chemical analysis applied to the ancient fountain of Peirene at Corinth, Greece, reveals why the ancient Greeks prized this famous spring. Historic records show that the ancients believed the water would improve the quality of bronze objects immersed in it, and a recent analysis of the spring shows they had good reason for thinking so. The water contains unusually high percentages of potassium, chloride, and silica, and, when it evaporates from a surface, leaves a residue that has the property of absorbing moisture, just as table salt and sugar absorb water in damp weather. Bronze on which this chemical layer had been allowed to form corrodes more easily than usual, and rapidly acquires the pleasing green color that enhances the beauty of bronze statuary. The chemical analysis was made in a new, completely equipped laboratory that has been set up in ancient Greek ruins to aid the archaeologists who are working there.

Success

while you are young enough to enjoy it

"I'M meeting Armstrong this afternoon at Ingleside—last chance for a little golf before we sail for Europe on the fifteenth . . ."

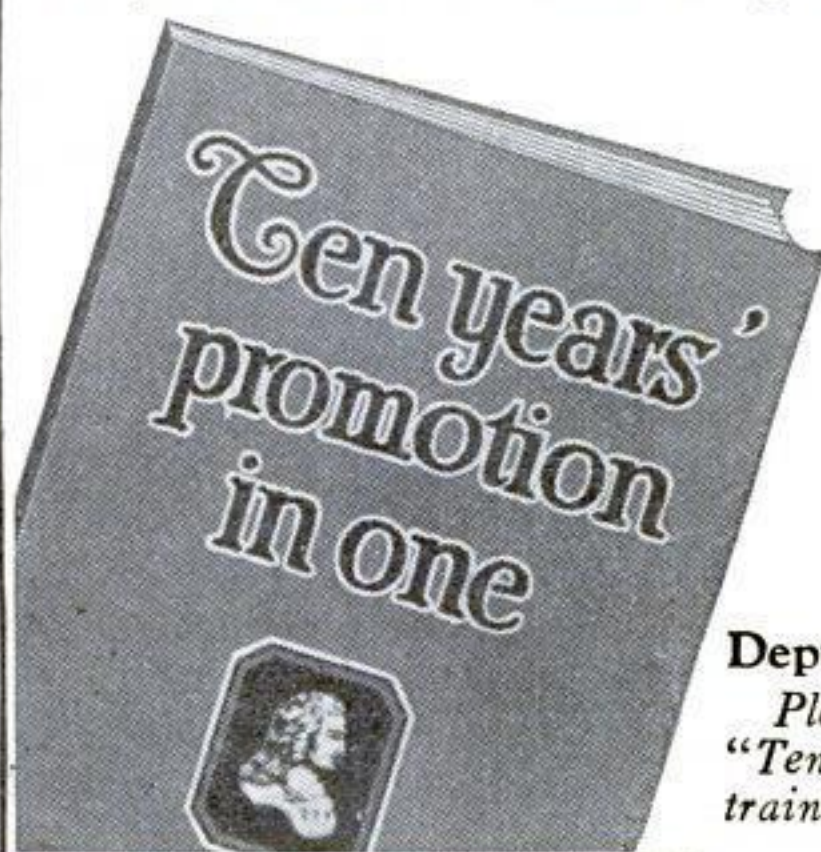
Pretty soft for Bob Carrington, you say—a lovely country home, golf on a week-day when the other boys are slaving at the office—a six weeks' trip to Europe with the family—and all this wonderful success while he is still young enough to enjoy it!

But why look with envy upon success well earned—*especially when it is within your power to attain that same success?*

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One of America's foremost business men—an active director in several big corporations—made that statement recently; and if you have the slightest doubt of its truth, you need only check it by the actual records of LaSalle-trained men, many of whom, though still in their thirties, are commanding enviable salaries.

Send for Free Book
"Ten Years' Promotion in One"
 "I'm determined to succeed," you say—and we do not deny that



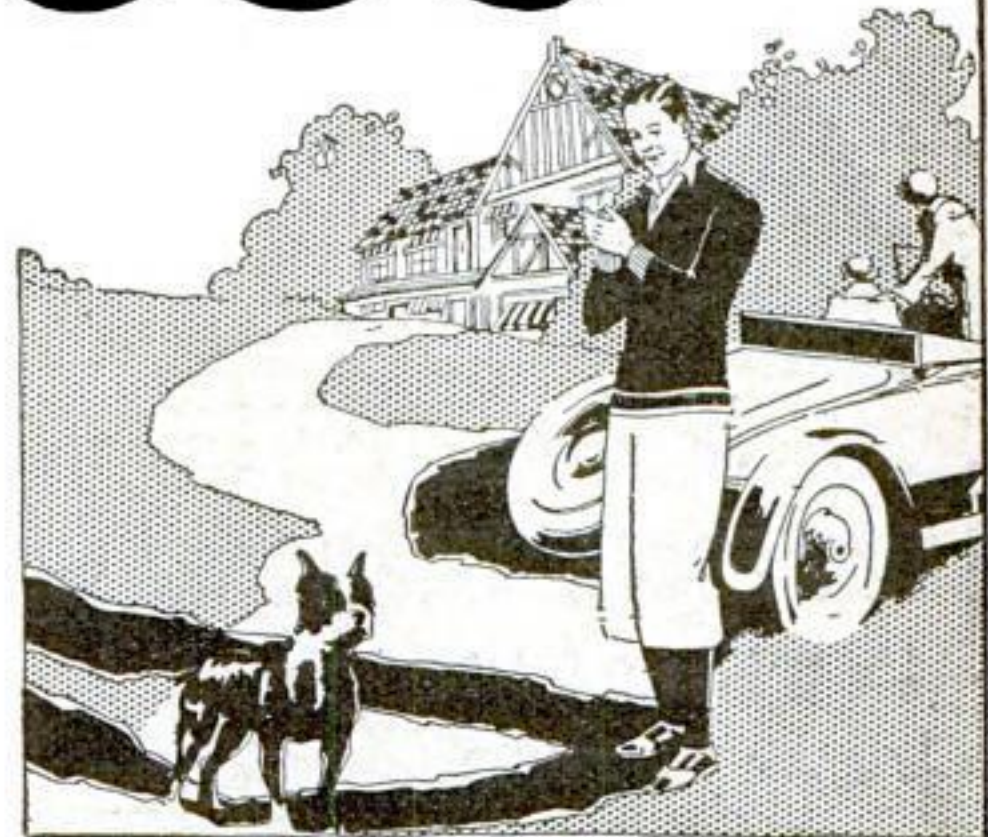
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hard work and learning through day-to-day experience will eventually win you some measure of success. If success is sweet, however, is it not doubly sweet if it comes to you while you are still young enough to enjoy it?

And is it not a needless and tragic waste of years to continue at outgrown tasks, simply because you will not spare yourself the time to master those bigger jobs that command the real rewards of business?

Ten Years' Promotion in One is a booklet that shows you how you can save years that might otherwise be wasted. Sending for it has marked the turning point in the lives of thousands of men—and the coupon will bring it to you FREE.

With this book we will send you, without cost or obligation, complete particulars of the training that appeals to you, together with details of our easy-payment plan.

Will you wait till the golden years of your life are fast slipping away—or will you set your path toward success while you are still young enough to enjoy it?

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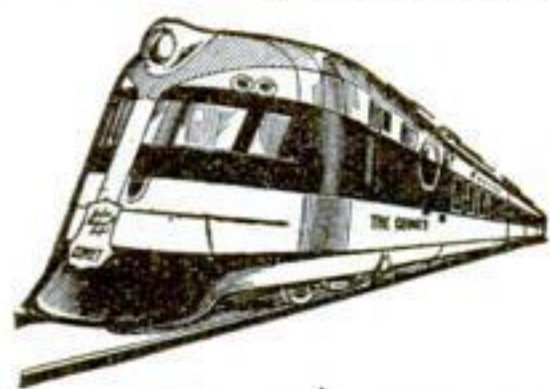
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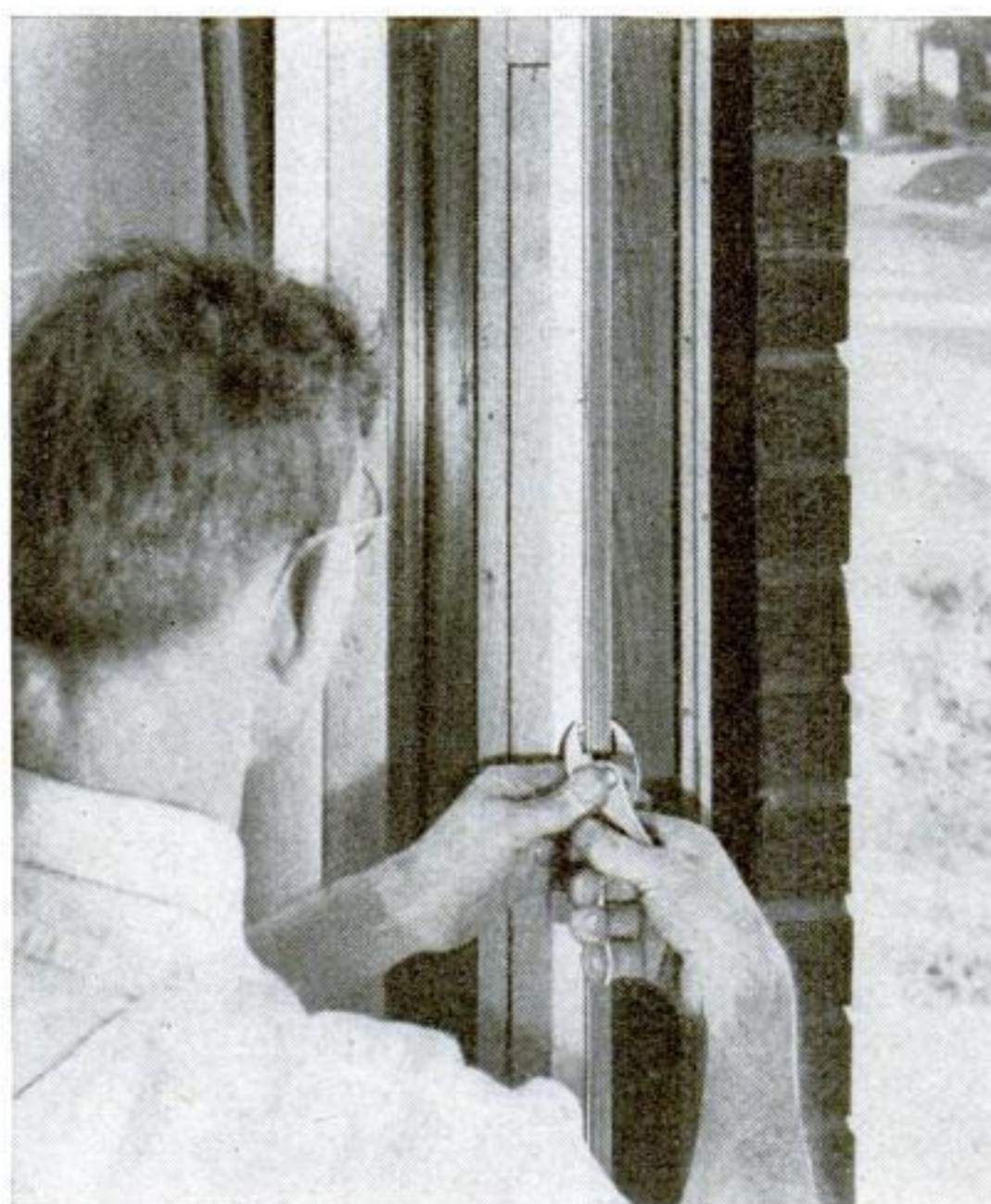
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American School, Dept. PA-746, Drexel at 58th, Chicago

New Tools and Materials for HOME BUILDING AND REPAIRS



Any home mechanic can install this new stripping

Weather-Stripping Is Tarnishproof

CUT to fit, weather-stripping now available for use on windows is made of a new metal alloy that will not corrode, oxidize, or turn black after exposure to the elements. Because it is thin and flexible, the metal weather-stripping is said to provide positive contact between the window and its frame, thus keeping both dust and moisture from seeping into a room. No routing or grooving is necessary before installation of the stripping, and any person handy with tools can quickly attach it with the aid of a pair of pliers. Nails and all other necessary accessories needed to attach it are included with the material.

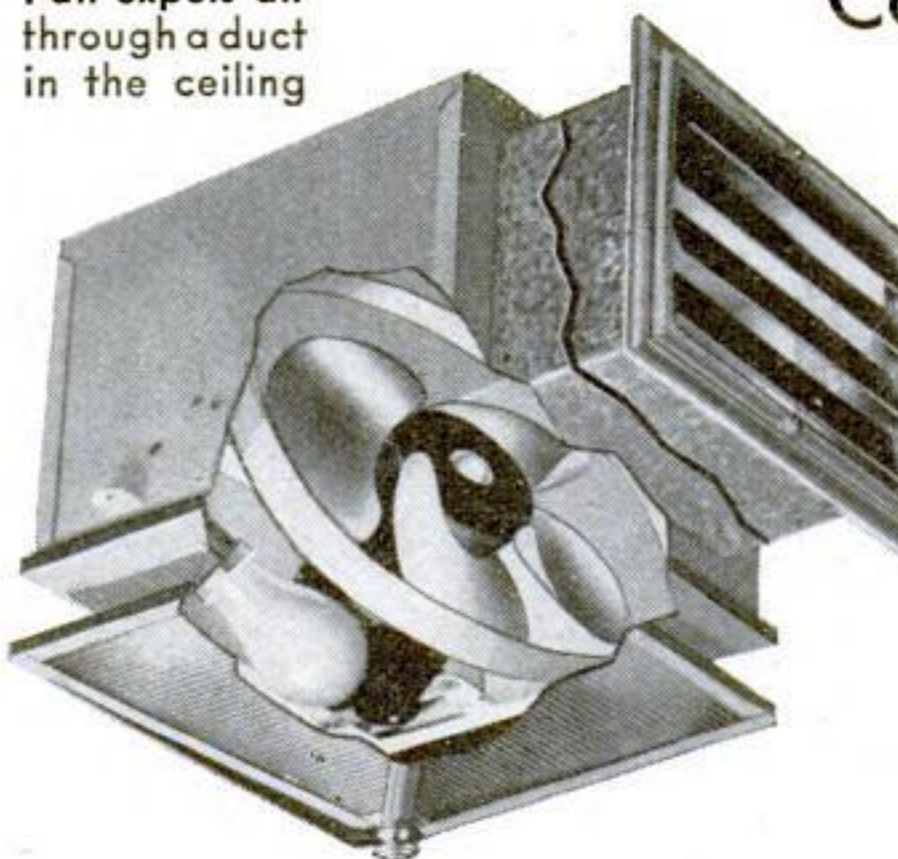
New Accessories Make Painting Easier

THREE accessories just introduced are designed to make painting easier and neater. The first, a combination spring-steel device that snaps on the side of a paint can, serves as a convenient handle and also as a brush holder, having a spring clip for suspending a brush over the paint. The second accessory is a wire that snaps across the can mouth to provide a wiping bar for the brush, while the third item is a brush holder for large-size cans, which also can be used to support a brush in turpentine for storage. The accessories are shown at the right.



Brush holders and wipe bars attached to paint cans

Fan expels air through a duct in the ceiling



Combination Unit Contains Light and Ventilator

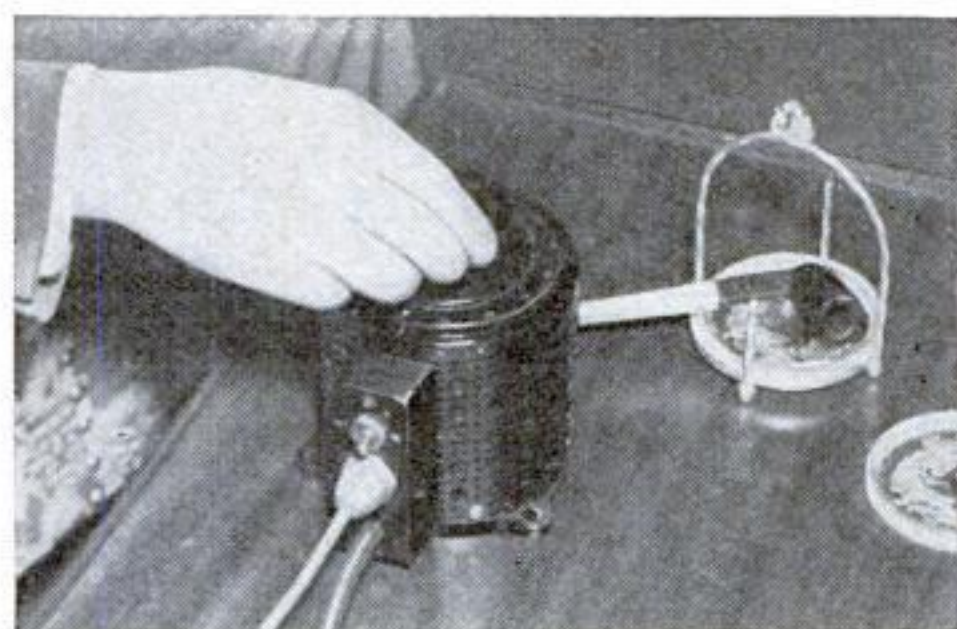
DISGUISED as an attractive lighting fixture, a new kitchen installation acts as both an illuminating and a ventilating unit. A prismatic glass panel conceals a light bulb and an electric fan that draws off cooking odors through adjustable louvers and expels them through a duct buried between the ceiling beams. A wall switch permits control of the hidden fan independently of the light. The space-saving device also can be installed in other rooms in a house.

Light Dimmer Controls Floor and Table Lamps



Floor and table lamps in a room are made dim or bright simply by turning the knob

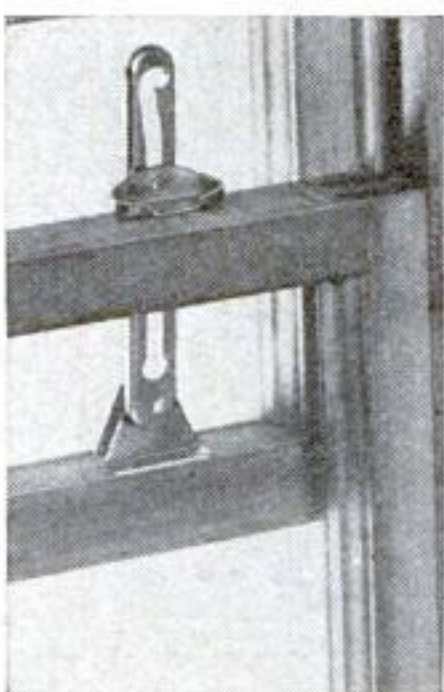
BY SIMPLY twisting the knob of a new lighting accessory, home owners can regulate the amount of illumination from floor and table lamps to suit any occasion. The dimming mechanism consists of a transformer governed by a rheostat control which can be set into the wall or housed in a portable, table-top unit to suit the requirements of the user.



Here the control is housed in a table-top unit

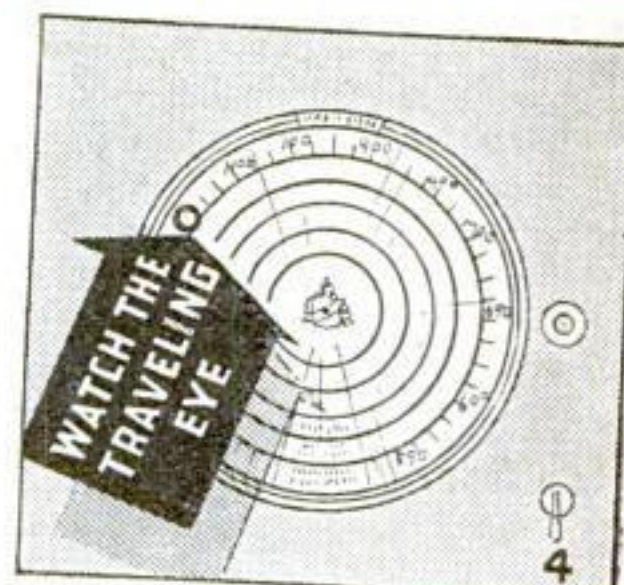
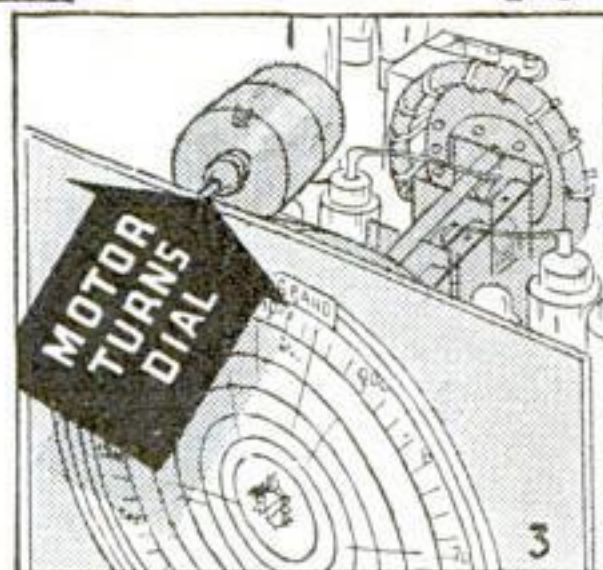
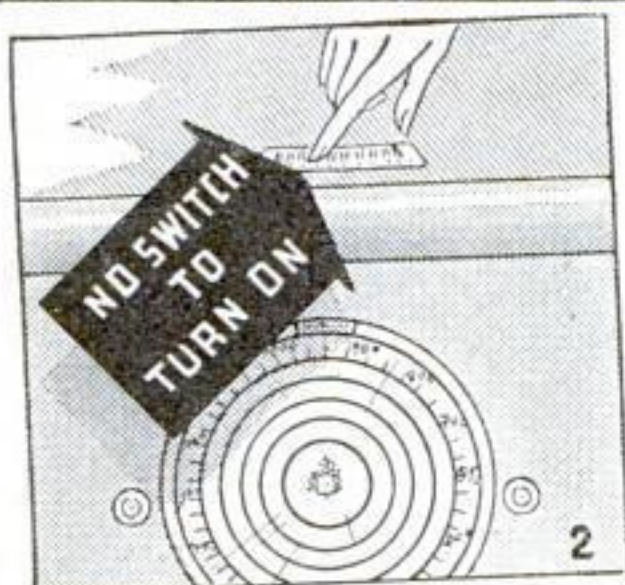
Slide Lock for Window Keeps Out Burglars

OPERATING like the chain locks used on doors, a new fastener permits a window to be raised four or five inches for ventilating purposes, but prevents intruders from forcing it open far enough to gain entrance. A metal pin, mounted on the top crossbar of the lower sash, slides in a slot cut out of a perpendicular metal plate screwed to the bottom crossbar of the upper frame. When desired, the lock can be released to permit full opening of the window.



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LATEST 18-TUBE MIDWEST TUNES ITSELF BY ELECTRIC MOTOR!



Now, you can enjoy the luxury of radio at its best—you can tune your Midwest by merely touching a button! Zip . . . Zip . . . Zip . . . you can bring in 9 perfectly tuned stations in 3 seconds. *All this happens in 1/4 second with Midwest Perfected MOTORIZED Tuning!* (See above illustrations). (1-2) You touch button; (3) Electric motor speeds dial towards corresponding station; (4) Colorful Bull's Eye darts across dial and locates itself behind station; (5) Dial stops itself at station's exact center of resonance and eye "winks" as program comes in perfectly tuned.

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Act at once on this unusual factory-to-you offer. We send any Midwest radio you desire to your home. You use it 30 days, and compare it with other radios you have owned or heard. Then, you can return it to the factory, if you wish, without risking a penny. You have a year to pay, if you decide to keep it. We trust you to give the Midwest a fair trial. You are triply protected with Foreign Reception Guarantee, One-Year Warranty and Money-Back Guarantee.

18 TUBES for PRICE of 10

Why be content with an ordinary 10, 12 or 14-tube set when you can buy an 18-tube Super DeLuxe 101-feature Motorized Midwest for the same money. It will surprise and delight you with its brilliant world-wide reception on 6 bands, and range of 12,000 and more miles! It will thrill you with its marvelous 6-continent overseas reception. Secures American, Canadian, Police, Amateur, Airplane, Ship broadcasts . . . and the finest foreign programs.

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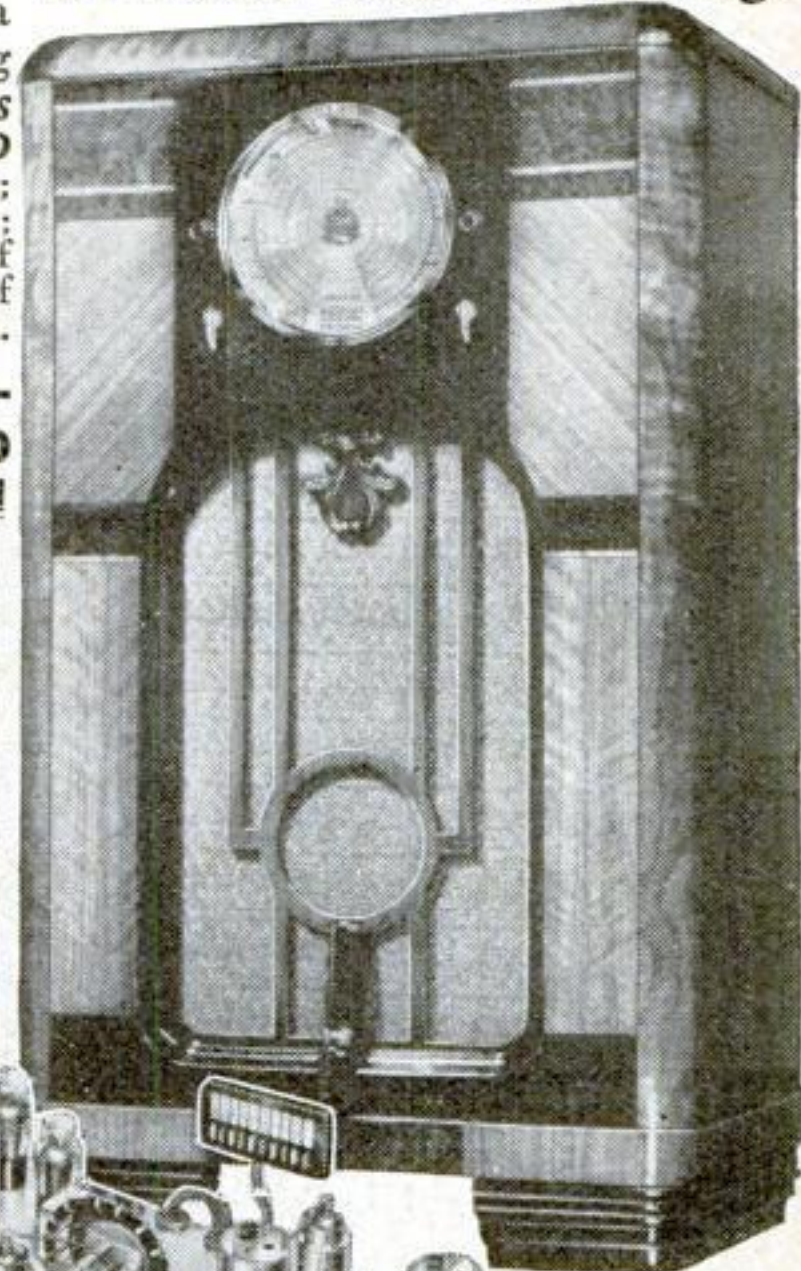
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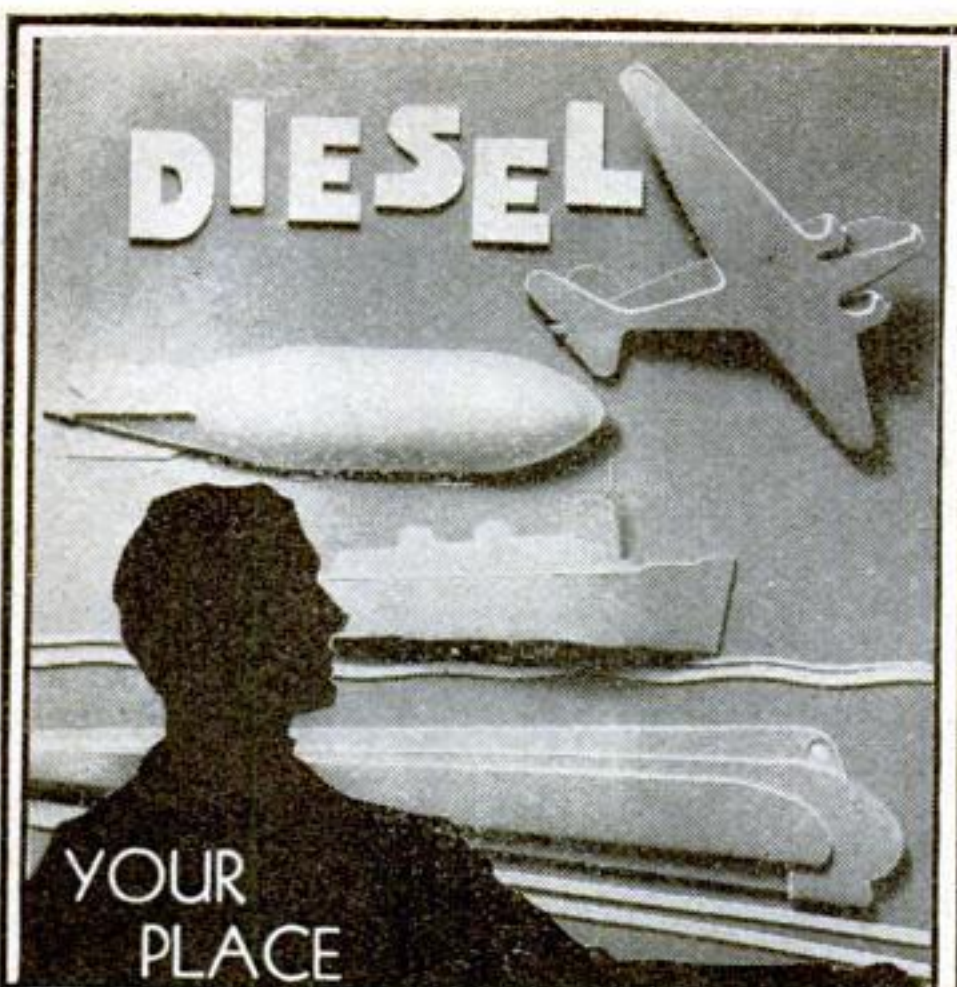
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A WEEK!

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IS IN THIS gigantic Diesel industry—somewhere—if you love machinery—are ambitious—and are properly trained. Here is Hemphill graduate Donald L. Smith's experience:

"I took the letter of introduction which you gave me and received employment immediately."

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Name Age
Street State
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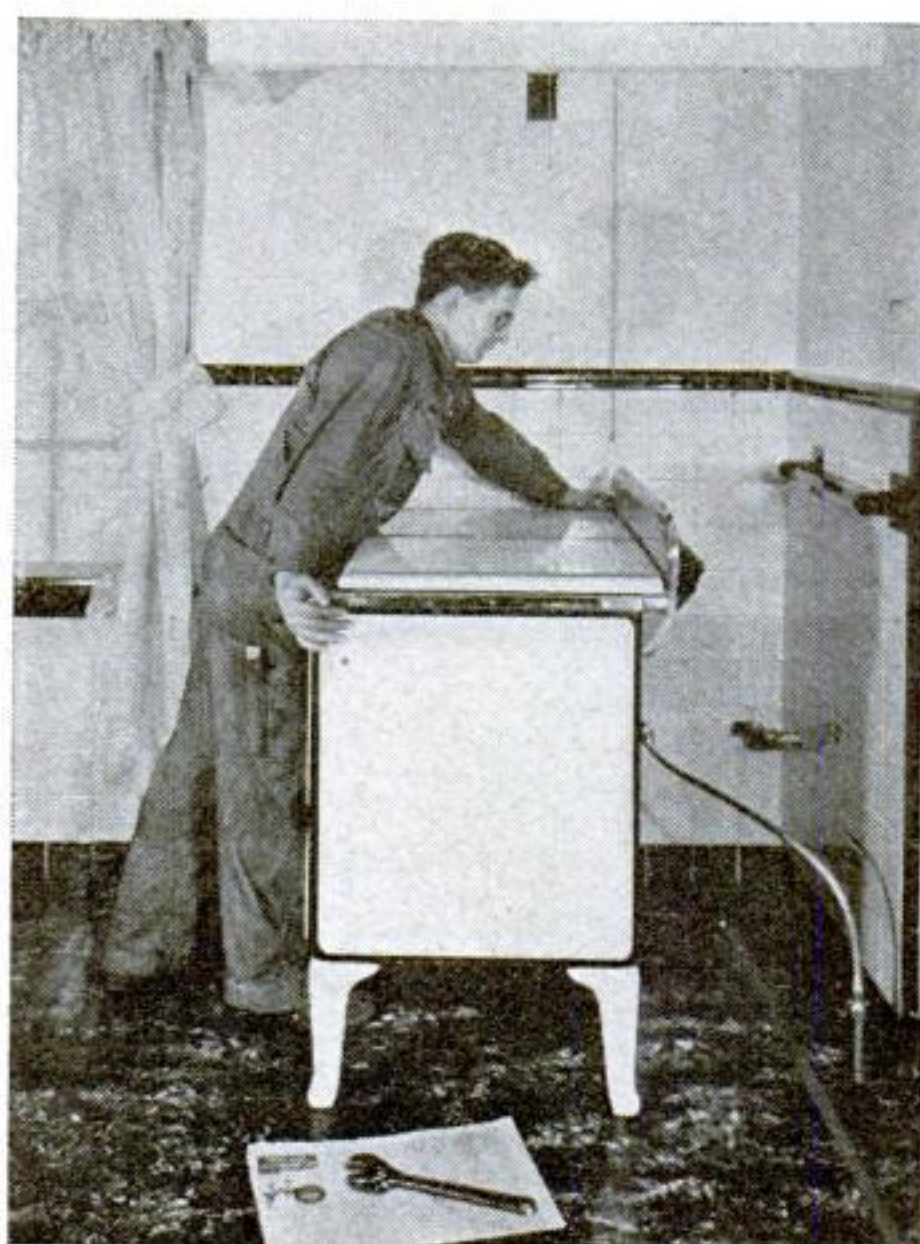
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Flexible Pipe Unit for Gas Stoves



Stove being put in place with aluminum connection. The pipe bends as needed

GAS STOVES are easily and quickly connected to gas lines with a pipe unit just placed on the market. Made of aluminum, the pipe is said to resist all bending and twisting strains and is guaranteed not to leak. Brass fittings on the ends of the flexible pipe are attached to the stove and to the gas line with an end wrench—the only tool required for installation. The unit makes it easy to connect stoves in cramped quarters and allows the cooking unit to be moved for cleaning the floor, painting the wall, or laying new linoleum. The connections for a stove can be made in less than three minutes.

Questions FROM HOME OWNERS

Q.—THE sorry state we generally find our summer camp in when we first arrive is probably caused by the hurried way in which we close it up the previous fall. This year I am determined to do a good closing job and would appreciate any suggestions as to important steps to take—M.E.R., Utica, N.Y.

A.—SOME of the more important points you might look out for are the following: Be sure to wrap screens with paper or canvas and store them in the driest possible place. Examine the roof carefully and repair any leaks, no matter how small. Clean out the leaves and accumulated debris from gutters and rain spouts. Remove all rubbish and burn it to prevent the possibility of fires starting by spontaneous combustion. Store matches in a glass or metal container. Clean and air the mechanical refrigerator or ice box. Ground the radio antenna (Continued on page 17)



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World's largest manufacturer announces sensational improvement in Band Instruments. New patented VO-CABELL revolutionizes tone effects. Easier to play. You'll develop talent fast with these new Conns. Choice of world's greatest artists. See your dealer or write today for FREE BOOK and home trial, easy payment offer. Mention instrument.

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Questions from Home Owners

(Continued from page 16)

on the outside. Draw the blinds after you have locked the windows. It is always wise to leave a key with local authorities in case of an emergency during the winter. If freezing weather is usual in the winter, all water pipes should be drained completely.

What To Do for Bookworms

Q.—WORMS have somehow gotten into a number of our books and are destroying the bindings and backings. Can you advise us if there is any way to get rid of these annoying pests?—G.A.L., Laconia, N.H.

A.—Shake the infested books vigorously and expose them to sunlight. Then moisten a cloth with formalin, a formaldehyde solution readily available at most drug stores, and wipe the covers and bindings thoroughly. If possible, pass the moistened rag through the space between the covers and the page edges. Before replacing the books on the shelves, moisten their bottom edges with the solution to allow the fumes to penetrate through the book.

Hardening Steel

F.G., PORTLAND, ORE. An easy method for hardening a piece of steel consists of immersing the metal in a tank of boiling linseed oil to which rosin has been added in the proportion of one eighth of a pound to a gallon of the oil. When the steel has reached the same temperature as the oil, remove it, dust it over with powdered rosin, and then plunge it into cold kerosene.

Fire-Extinguishing Bombs

D.C.C., BOSTON, MASS. An inexpensive fire extinguisher can be made from an old electric-light bulb. Remove the metal part of the bulb and dip the tubular end in carbon tetrachloride, a chemical readily available at drug stores. Break the end of the tube, and the vacuum will draw the liquid into the bulb. The break can then be sealed with wax. Make several of these and store them in easily accessible locations about the house. If a fire occurs, throw one of the fire-extinguishing bombs at the base of the flames. Fumes from the liquid will smother the fire.

Joining Glass to Brass

C.O.J., OMAHA, NEB. A good adhesive for joining glass to brass can be made by boiling together the following ingredients: five parts water, one part caustic soda, and three parts each of rosin and plaster of Paris. Be sure to boil the mixture until all lumps disappear. Cool before using.



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Motorists Go Faster Away from Home

MOTORISTS drive faster when they are far from home, traffic experts conclude, after a series of tests in Connecticut. Observers sat in cars parked inconspicuously beside highways, and were provided with mirrors that enabled them to watch the progress of passing cars past two distant points. Stopwatch timing thus was possible without passing drivers being aware that their speed was being checked. Figures accumulated during the tests show that local drivers, traveling on their own highways, showed an average speed of 38.2 miles an hour. Motorists from the adjoining state, New York, averaged 40.3 miles an hour, while cars from middle-western states, 1,000 miles away from home, traveled at a 44.9-mile clip. An interesting observation made during the tests is the fact that cars with passengers in them travel at a lower speed, generally, than those in which the driver is alone.

Sewage Gas Is Fuel for German Trucks

SEWAGE GAS is the odd fuel being used to drive municipal trucks and other heavy vehicles in Berlin. German engineers have erected several plants where gas from the city's sewers is compressed and stored in tanks of 500-cubic-foot capacity. Three such tankfuls of the gas will run a five-ton truck for about 225 miles, a cruising range sufficient for all ordinary runs.

New Processes Double Life of Steel Parts

THE average life of finished steel parts has more than doubled in the last fifty years, a recent report shows. In 1886, a piece of steel could be expected to remain in service for only fifteen years. Today the life span of the average piece of steel is calculated at thirty-three and a half years, more than twice the previous figure. Much of the increase in life of the metal is attributed to the elimination, in manufacture, of impurities that weakened the metal and made it more susceptible to rust; also, the increase in the use of corrosion-resistant alloy steels has helped to boost the average figure. Users of steel also have developed new ways of protecting the metal with paints, plating, and other corrosion-resistant coatings. A majority of the processes that have increased the life of steel were developed since the World War.

Giant Human Skull Is Fair Exhibit

BUILT like a planetarium, a huge model of the human head will be a feature of the coming world's fair in New York City. Visitors will be able to enter the model and stroll over the teeth and tongue, and even enter the throat and breathing passages. A guide will be stationed within the giant skull to point out the nerve centers that govern sight, hearing, and smell, as well as the other intricate structures of a man's head. A striking feature will be the brain and its vital cells.

Sound Pictures Give Illusion of Depth

TALKING PICTURES that give the audience the impression that the sound emanates from a three-dimensional source are promised in a system invented by a New Jersey man. Sound technicians classify the sound-track record according to its "liveliness." If the speech of an actor is accompanied by reverberations, it is said to be lively, and gives the illusion that it comes from a great distance. A sound that has little liveliness appears to come from close at hand, and is suitable for close-up shots. To combine and control these qualities, the inventor proposes to make two simultaneous sound recordings during the filming of a motion picture. One, with little liveliness, is produced by a microphone close to the performer, while the second, made at a great distance, has a high liveliness factor. When the film is cut and edited, the two sound tracks are reproduced together, and are mixed in suitable proportions to give the proper effect of perspective, depending on the actor's nearness to the camera. The finished movie is shown in timed relation with the sound.



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Palm Trees Yield Wine When Sap Ferments

PALM TREES that yield wine were reported recently by an explorer returning from southeastern Mexico. To obtain the drink, natives cut down the tree, scoop out a small trough in the trunk, and cover the opening with leaves. After two days, they return to find that the cavity is filled with a delicious red wine. The beverage, formed by the fermentation of sap in the tree, is said to be equal to the best vintage wines of France.

Sprayers on Trucks Fight Insect Pests

HEAVY tank sprayers, mounted on trucks, are among the weapons being used by German agricultural experts to combat an insect plague that began during the world war. Potato beetles, brought to Europe by American soldiers, have spread through French fields for the last two decades. Now they are invading German territory in the Saar region, and lead arsenate sprays are being used in an effort to check their advance.

Buried Radio Sends Blind-landing Beam

INSTALLED UNDERGROUND at the center of a commercial airport, a transmitting apparatus for blind-landing by radio beams is expected to insure greater safety for airplanes approaching the field over obstructions, according to scientists of the National Bureau of Standards. Past installations have been above ground outside of the airport boundaries. The new principle permits a sharp increase in the angle of the landing beam. A unique turntable for the apparatus allows the beam to be rotated so that planes may approach the field into the wind. Signals are not blocked out by the walls of the installation pit, it is said.

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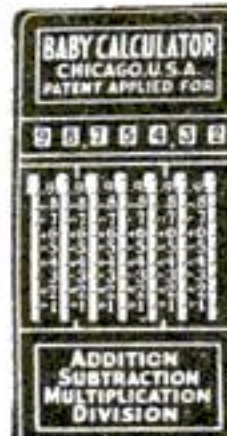
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The draftsman has been called the Junior Engineer which title just about describes his work, position and pay. He combines his knowledge of principles, mechanism and construction details with the ability to draw plans and indicate motions and methods on paper. On the average, his salary is considerably above the wages of the mechanic and, of course, less than that of the engineer.

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naval destroyer is carried in a special compartment. The hull, completely soundproofed, has commodious living quarters for the crew, a mechanic's workshop, and galley. An electric stove, a dry-ice refrigerator, and a water distiller are provided for the comfort of the staff during the long-range flights of which the aerial battleship is capable. A novel feature of the craft is a complete, 110-volt electrical system driven by an auxiliary gasoline engine. Thousands of feet of wiring run through the structures of the ship, among them being a complete telephone system that provides two-way communication between all parts of the giant ship.

Chemical Process Makes Wool Unshrinkable

UNSHRINKABLE wool, the goal of experimenters for years, is claimed to be achieved by a new English process. Previous methods of preshrinking woolen fabrics have been impractical because they made the cloth less durable, or affected its softness and feel. The new process consists merely of dipping the wool in a bath of sulfuryl chloride solution for about an hour. The wool can be treated as it comes off the sheep's back, or after it has been spun and woven into clothing, whichever is most convenient. It does not have to be washed first, or treated in

any way. The color, whether natural or dyed, is unaffected, and the strength of the fibers is not noticeably impaired. Microscopic examination reveals no sign of chemical change in the wool. The process is said to be economical, because the chemical bath can be used over and over again; the inventor used the same solution over a year. Wool mixed with cotton or rayon also can be treated without harming these parts of the fabric. Licenses for the use of the new process have been taken out by many of the leading textile firms throughout the world.

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(Continued on page 23)



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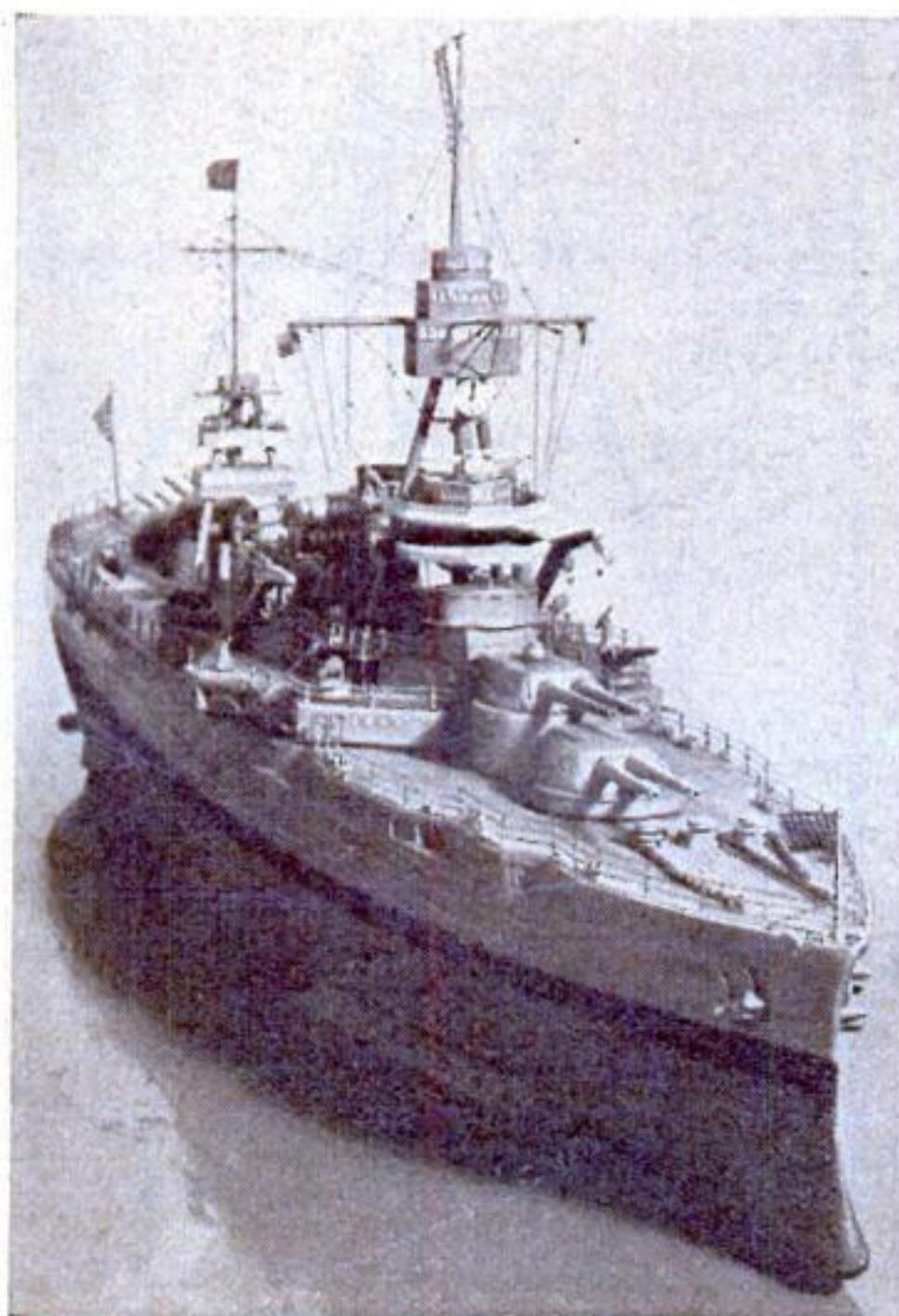
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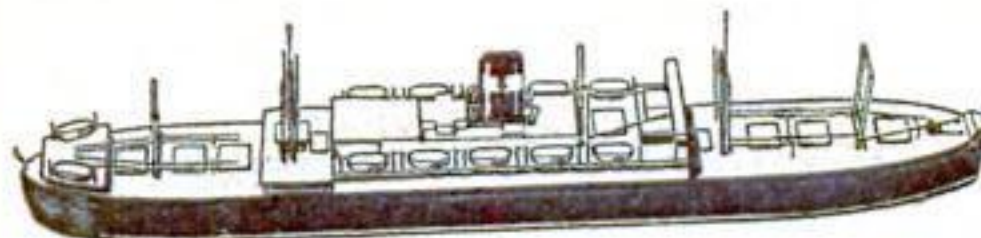
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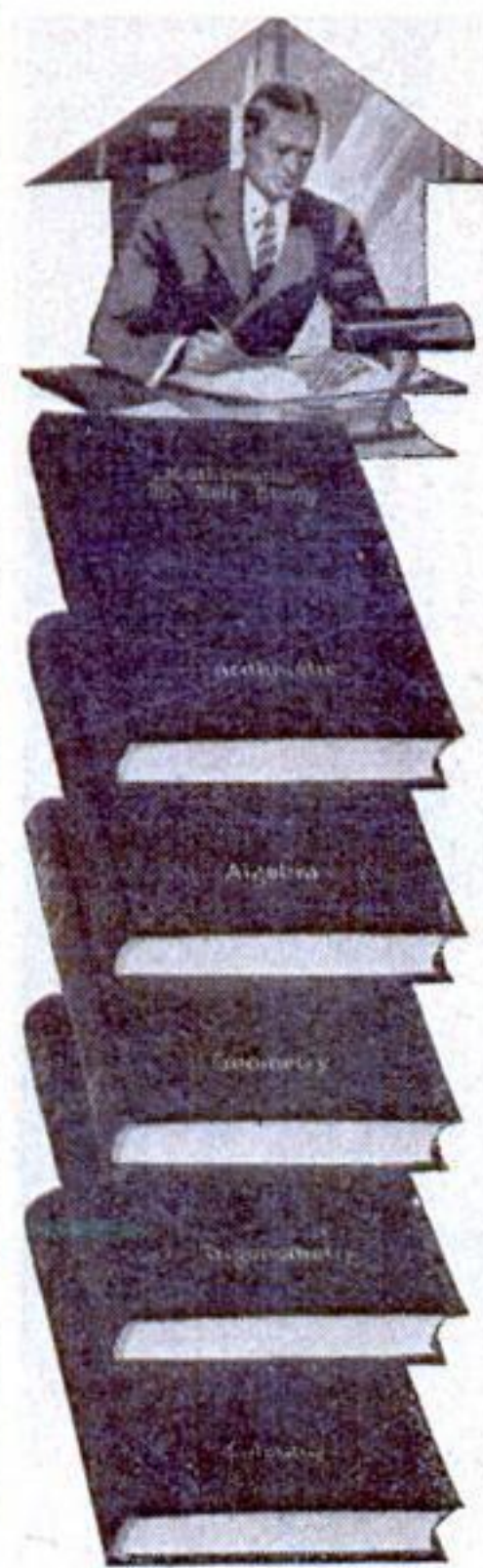
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(Continued on page 24)



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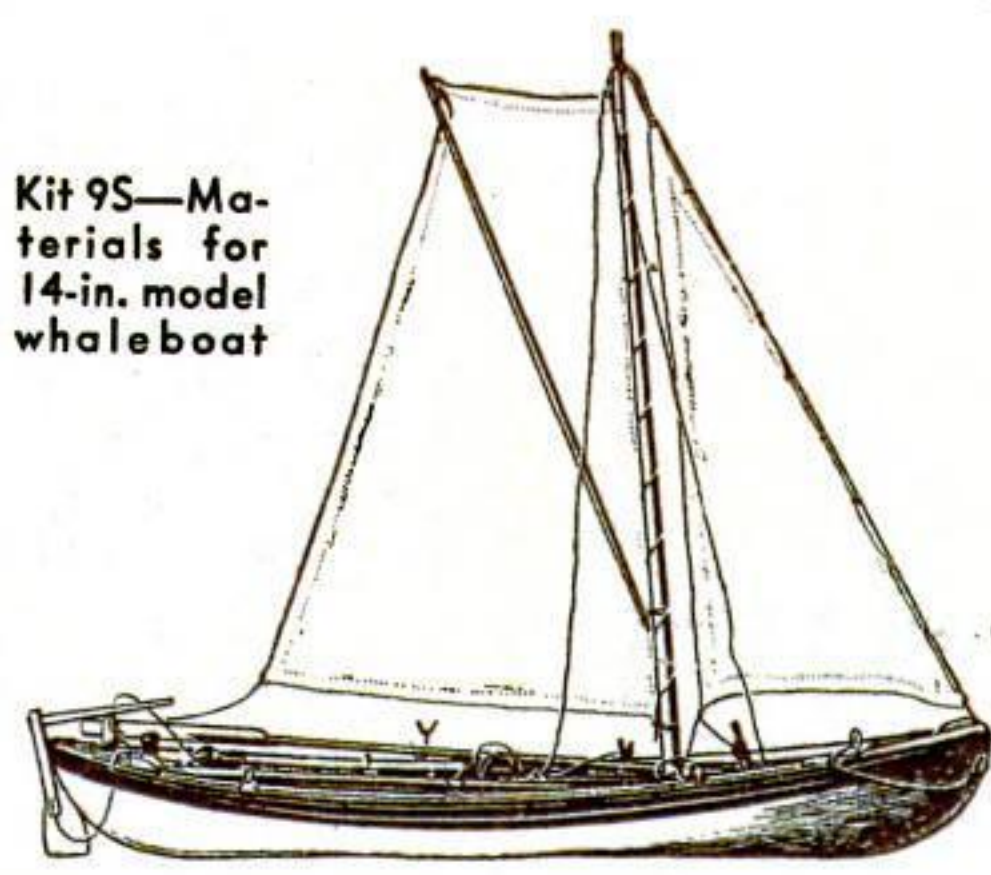
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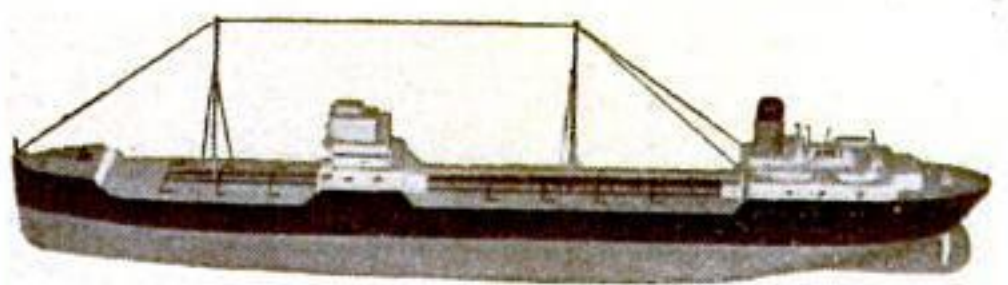
(Continued from page 23)



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SIX times as fast as the fastest candid-camera lenses, a new telescope eye in use at the Mount Wilson, Calif., observatory has photographed nebulae so dim that they are 30,000 times fainter than the duller visible star. The new lens, used in conjunction with the observatory's 100-inch telescope, is said to be the fastest in the world. It has an optical speed of F/0.59, whereas the largest aperture in use on the modern, high-speed miniature camera is F/1.5, a difference of 600 percent. The light reflected from the big, 8 1/3-foot telescope mirror is concentrated by the new lens into an image only two twenty-fifths of an inch long. So little light reaches the film, in taking pictures of the nebula, even with the high-speed lens, that an exposure as long as sixty hours is necessary to take the photograph.

Fire Bricks Wrapped in Steel Jackets

FIRE bricks for metallurgical furnaces, where very high temperatures must be withstood, now are made with steel jackets. Previous types of bricks for use under severe temperature conditions were physically weak, and their use was thus limited. The new blocks, after being molded under high pressure, are encased in three sides in a jacket of heavy steel, then laid in the furnace so the wall is lined with a complete lattice of steel. In use, the edges of the steel melt and fuse with the brick itself, forming a highly resistant surface. A short distance back from the heated face, however, the steel remains intact, adding greatly to the strength of the wall.

New Fiber Wall Board is Stronger than Wood

STRONGER than wood, and said to have three times that material's heat-insulating qualities, a new fiber board has recently completed laboratory tests at Columbia University, New York City. Fibrous material left from sugar-cane stalks after the juices are extracted are pressed into panels an inch thick, four feet wide, and twelve feet long. These panels are coated with a layer of black asphalt that prevents the penetration of moisture, and one side is sprayed with a thin aluminum coating. This serves to reflect heat, while the porous texture of the board itself makes it a poor conductor of heat. Tests made at the university show that this material is more than three times as strong as horizontal wood sheathing, and twenty-eight percent stronger than diagonal sheathing commonly used. It has been accepted as a construction material by the building department of New York City.

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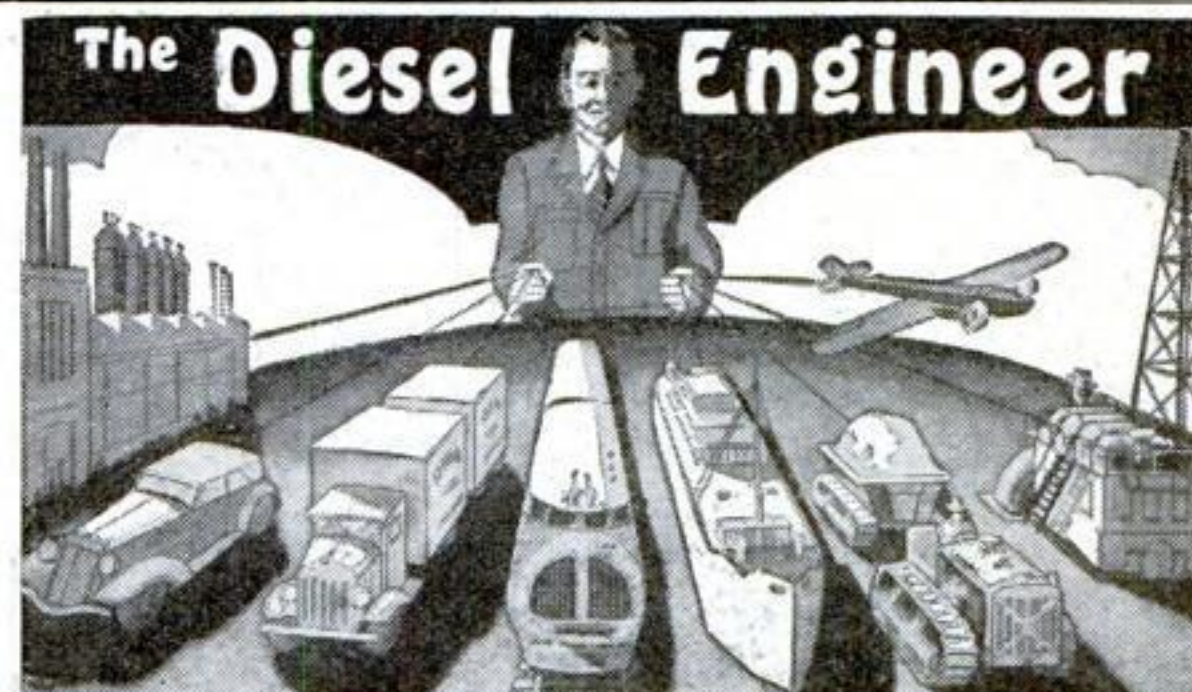
\$25,000 has been placed in escrow with the Hollywood State Bank, Hollywood, California, to guarantee the granting of the 100 scholarships to the winners. (Escrow No. 3955)

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Powerful Movie Lens is Four Feet Long

CALLED the most powerful in the world, a telescopic movie-camera lens four feet long and eight inches in diameter has been constructed in England and placed in service for newsreel photography. When it is trained upon a man 250 feet away, his head and shoulders cover the entire picture, and a full-length view of a person that will fill a theater screen is obtained at a distance of 750 feet. Armed with the new equipment, a photographer can film public ceremonies from a point of vantage well away from the crowd. Applications also are foreseen for military purposes, as in checking the accuracy of artillery fire against a distant target. The effectiveness of the lens in such long-distance work was demonstrated in one experiment when it took a picture clearly showing the wires of the short-wave radio antenna of a London television-broadcasting station at a distance six miles away, although even the tower on which the aerial was mounted was barely discernible to the eye at this distance.

Uranium Prolongs Life of Electric Bulbs

URANIUM, the mother element of radium, increases the life span of high-power electric bulbs, in a recently patented process. Powerful lamps, such as those used in photography and for motion picture projectors, are subject to a sudden surge of current when the electricity is turned on. This momentary overload reduces the life of the filament, especially when a lamp is turned on and off frequently. If a tiny capsule of uranium oxide is connected in series with the lamp filament, the inventor discovered, this surge of current is eliminated, thus prolonging the life of the lamp.

Bees Report Nectar by Doing a Dance

BEEES communicate with each other in the language of the dance, a German scientist reports. When a bee discovers a source of honey, he loads up with the nectar and starts for the hive, where he reports the discovery by a queer sort of dance, turning round and round in a circle, with little, tripping steps. The other bees crowd around, then rush out and find their way to the nectar-bearing blossoms. The dance, it is explained, is a sign that treasure has been found; the bee carries on him the scent of the nectar, which the other bees use to guide them to the place where the discovery was made. In addition, a bee can broadcast another odor by means of an organ on his abdomen, for the guidance of the other members of the hive.

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Best Eclipse Pictures Taken by Amateur

AN AMATEUR astronomer, Fernando de Romana, of Arequipa, Peru, made some of the finest photographs ever taken of the sun's corona during the eclipse of June 8, 1937, according to an announcement issued recently by Harvard University. Using his own hand-operated telescope camera, with special light-polarizing screens lent to him by the university, Romana obtained four photographs that clearly illustrate the effect of polarization in the light of the corona. He also made four fine pictures of the sun as it appears to the naked eye, unaffected by the polarizing screens. Harvard officials, it is explained, had decided not to make any pictures of the June eclipse, but Romana's request for advice resulted in their lending him the valuable equipment.

Teeth, Like Trees, Show Growth Rings

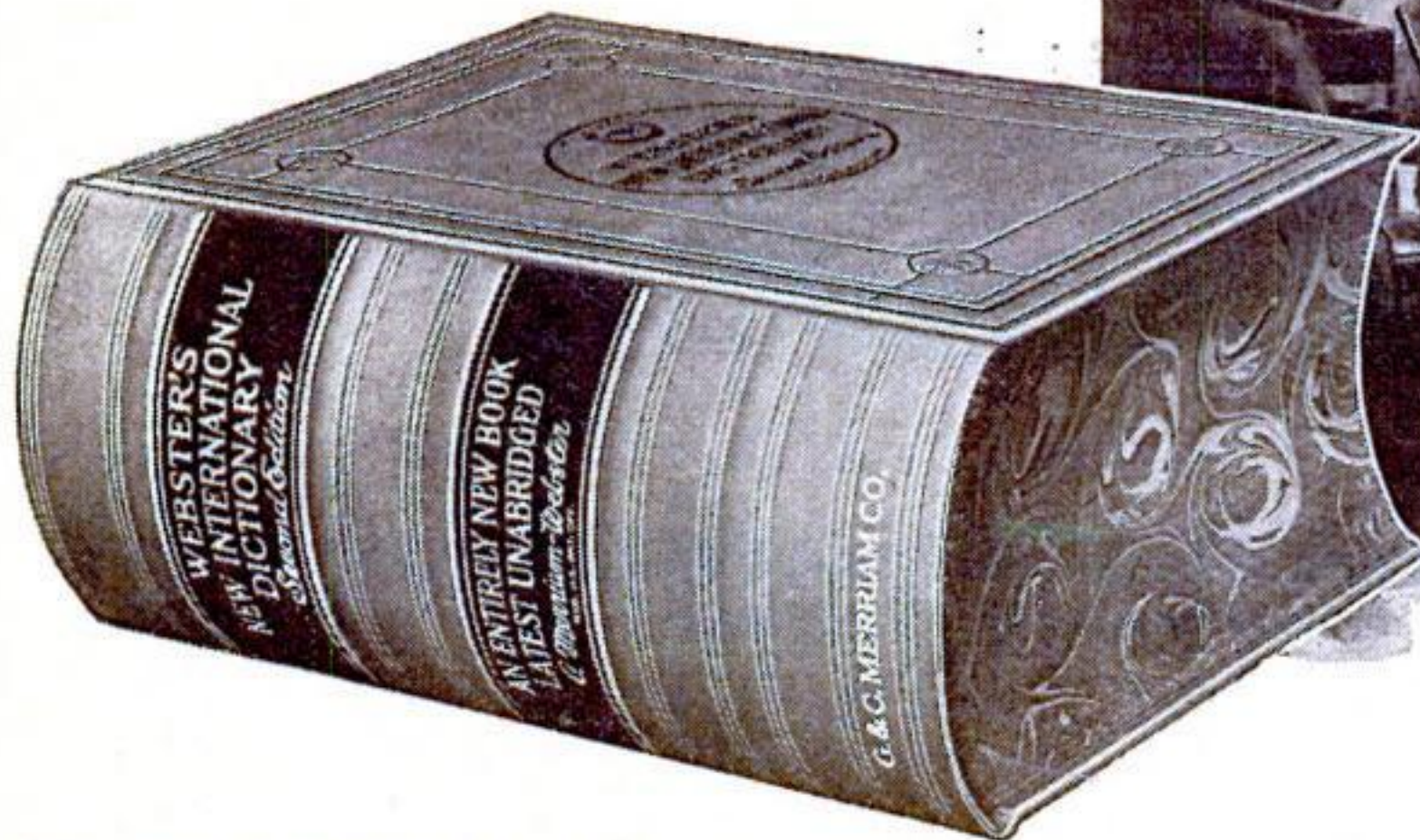
HUMAN teeth, like tree trunks, carry a record of the owner's growth and medical history in the form of rings laid down at regular intervals, recent investigations reveal. Each four days, a new ring forms on the teeth of a growing child. Such rings are not visible to the naked eye, but are made visible under a microscope by special treatment. Diseases leave their marks in the changes that can be found in the structure of the rings that were formed during the course of the illness, and the experience of birth leaves its own special ring, different from all the rest, making it possible to compare the amount and quality of the tooth before as well as after birth.

Army Doctors Study "Aviator's Ear"

"AVIATOR'S EAR," a condition that affects airmen and passengers in high-flying transport planes, has received attention lately from the U.S. Army Medical Corps. The difficulty is caused by the difference in pressure between the air in the cavity behind the ear and that on the outside of the ear drum. As a plane ascends, the outside air pressure decreases, but the air trapped in head passages retains the ground-level pressure. The condition most readily attacks persons who are ill, asleep, or have a bad cold. For this reason, most experienced aviators try to avoid flying when they have bad colds because of the discomfort and pain they feel in their ears. Pain and inflammation, ringing, and deafness are the most common manifestations. Often the trouble can be avoided simply by swallowing. Yawning, singing, and shouting also help. A maneuver described as stifling an imaginary yawn also will relieve the pain.

I turned inquiring Reporter

before I invested my money
in a new dictionary. Here are
some of the facts I discovered:



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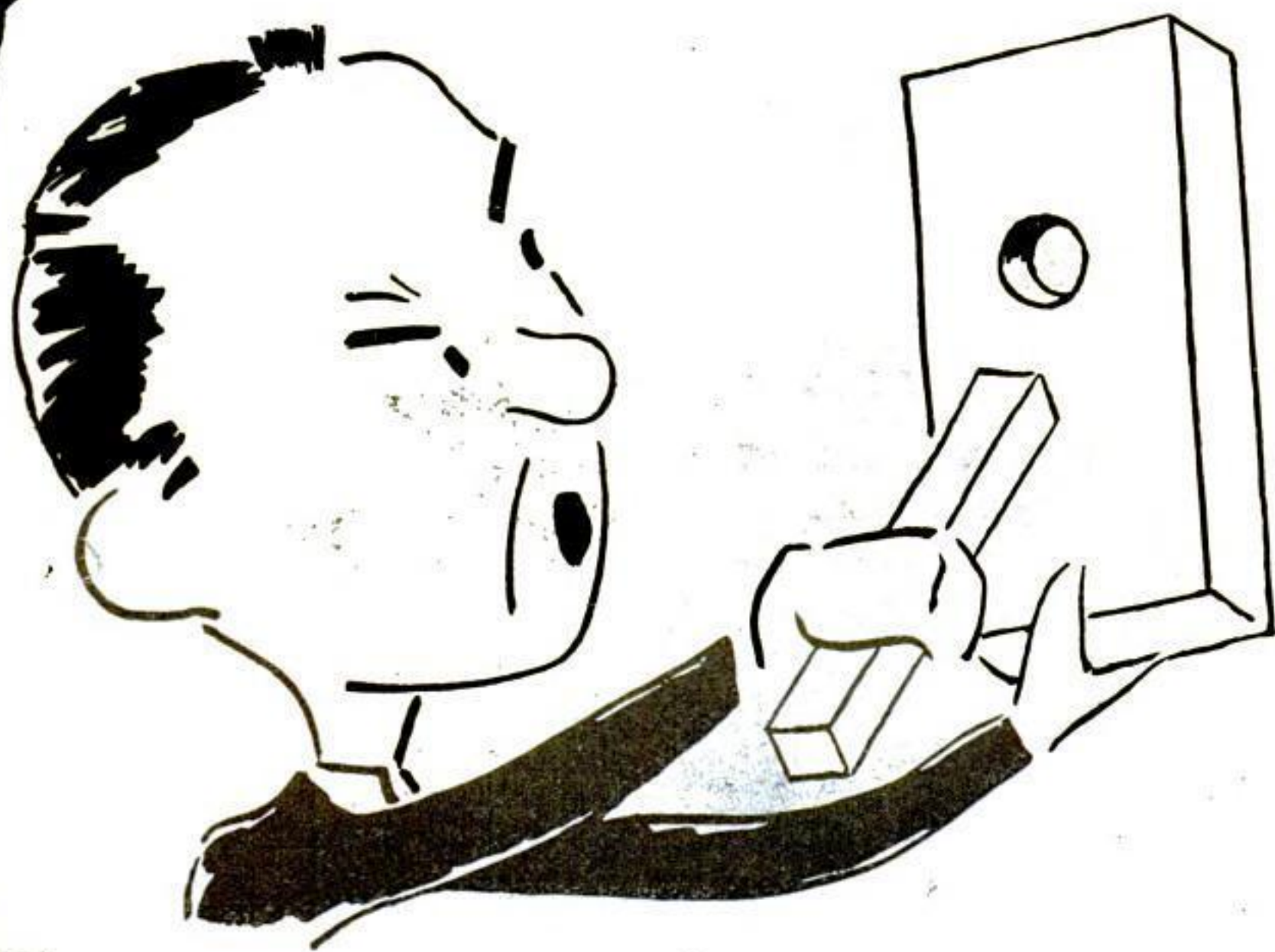
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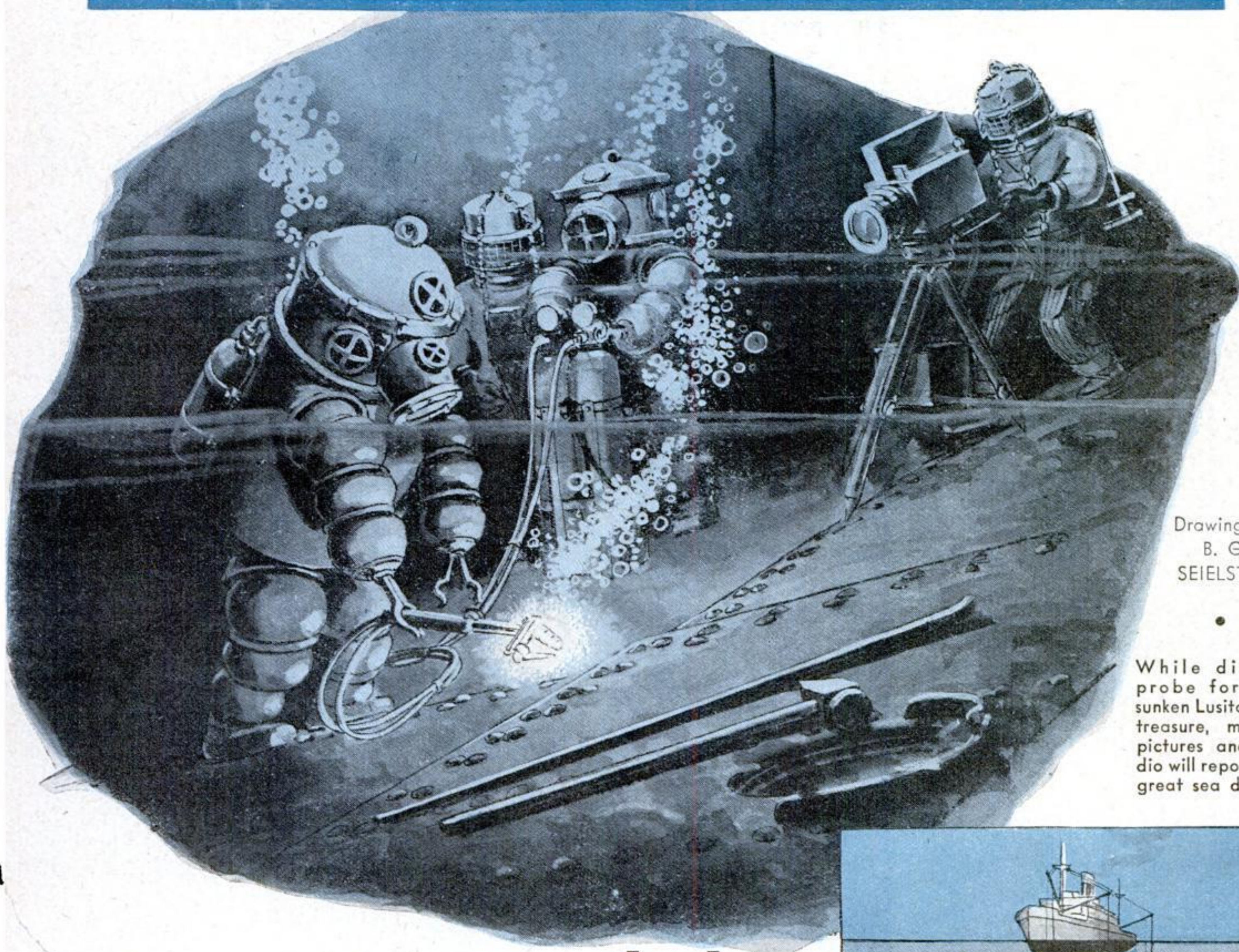
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While divers probe for the sunken *Lusitania's* treasure, motion pictures and radio will report the great sea drama

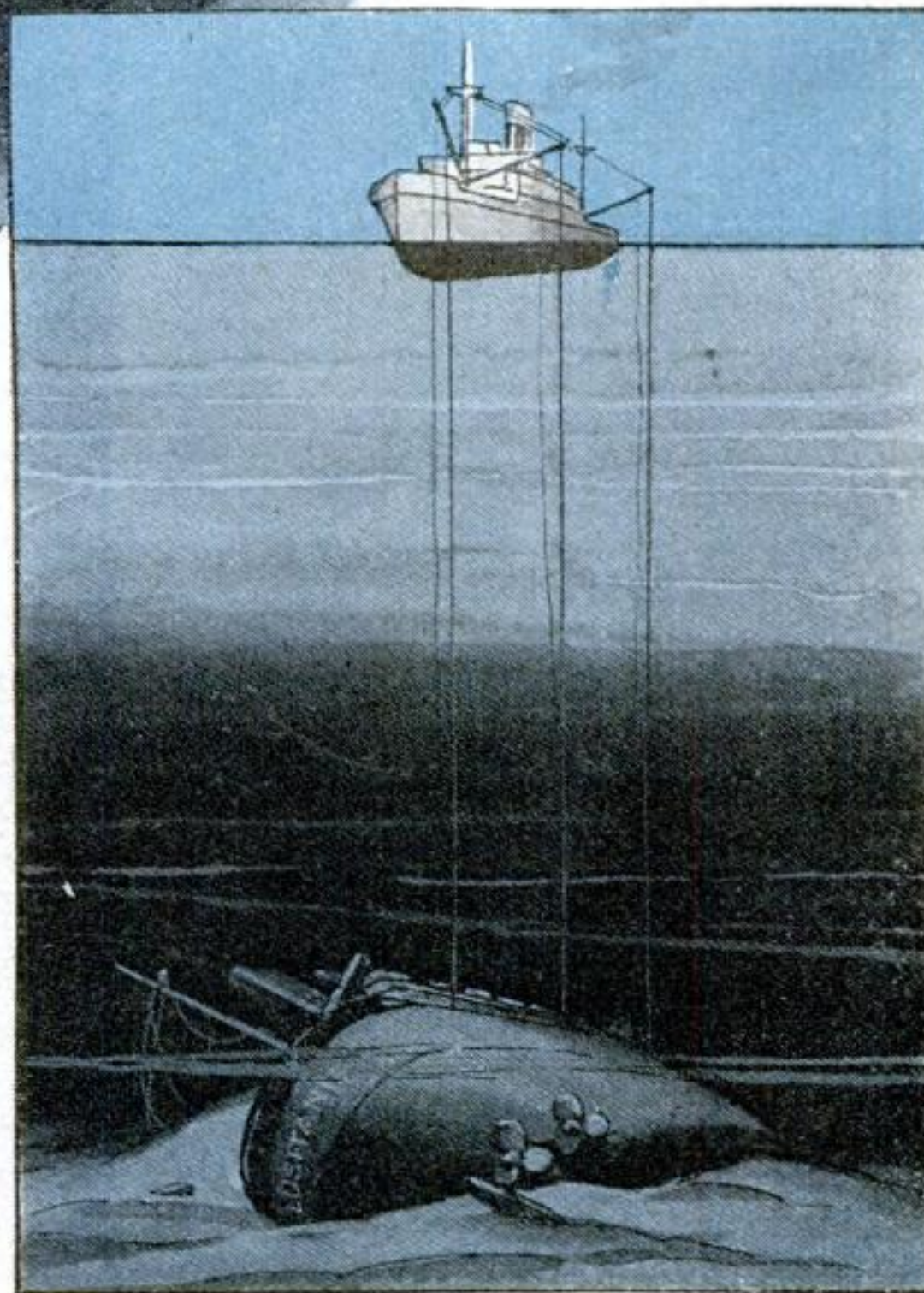
New Worlds BENEATH THE SEA

By Edwin Teale

UNDER the sliding waves of the gray Atlantic, twelve miles off the southern tip of Ireland, one of the great dramas of the sea is about to begin. Working more than 300 feet below the surface, daring men in ingenious, scientifically designed diving suits will seek the gold of the sunken *Lusitania*. In addition, they will make underwater sound movies of the salvage work and broadcast a step-by-step radio report of operations from the floor of the ocean. Davy Jones's fabulous locker will thus be transformed in-

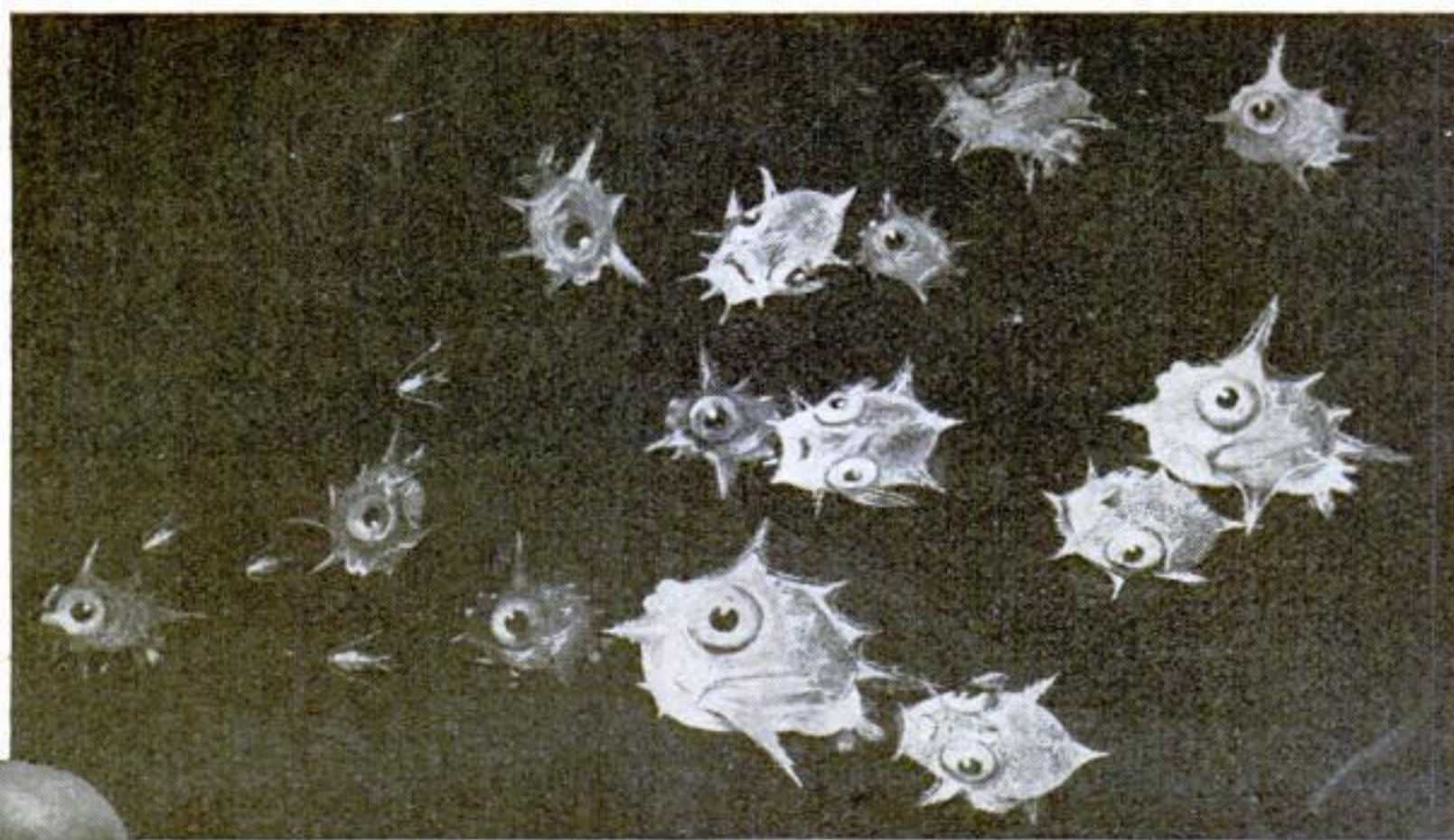
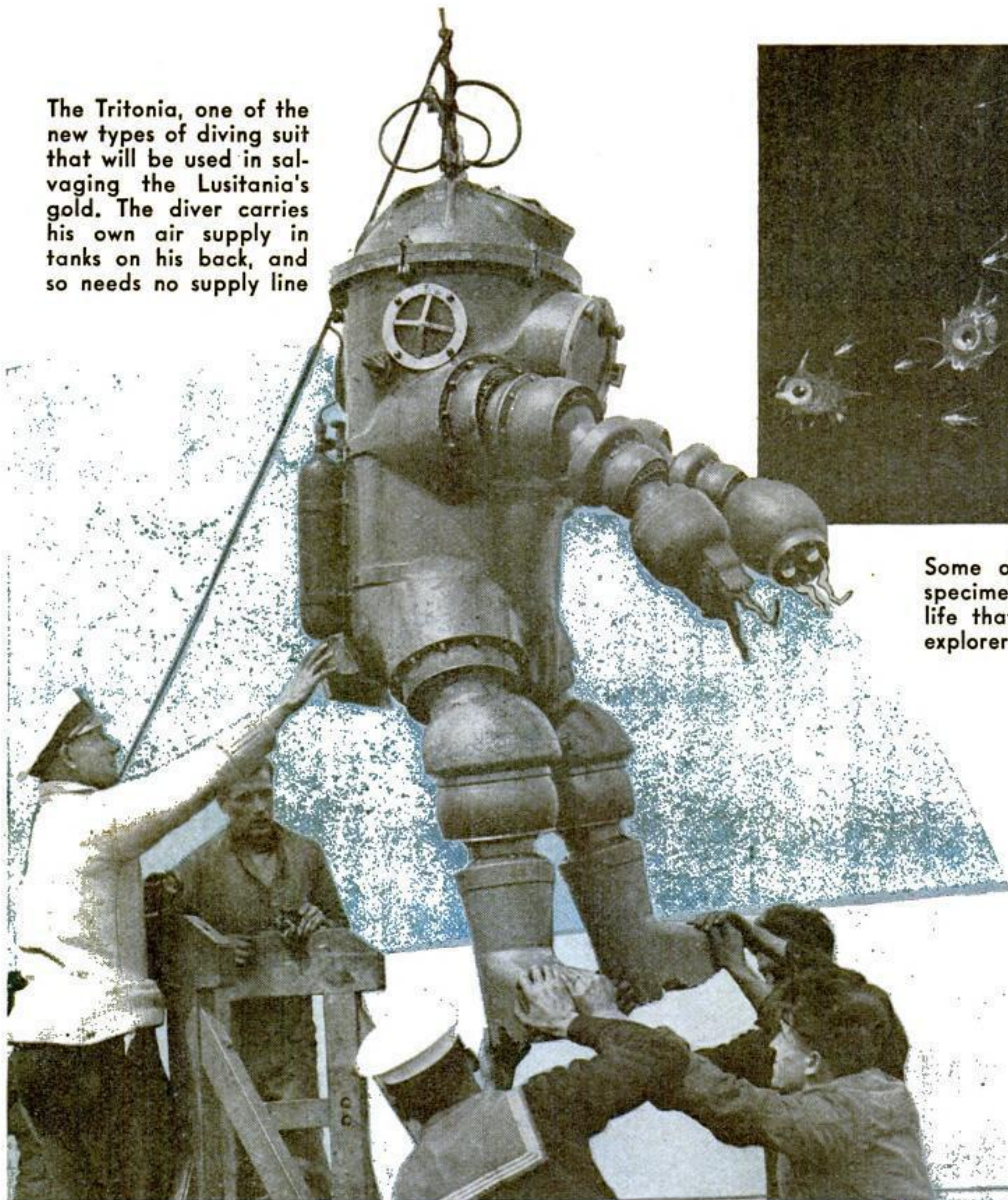
to a broadcasting studio and a movie set.

In preparation for this adventure, two Americans, Capt. John D. Craig and Max E. Nohl, have tested their equipment in the still waters of Maine quarries, in the



DAVY JONES'S LOCKER YIELDS VAST REALM FOR EXPLORATION

The Tritonia, one of the new types of diving suit that will be used in salvaging the Lusitania's gold. The diver carries his own air supply in tanks on his back, and so needs no supply line



Some of the strange specimens of marine life that are seen by explorers of the deep

which the vessel carried.

Their attempt to snatch this rich prize from the sea focuses attention once more upon the last frontier of exploration—the world of the ocean bottom. Airplanes have soared over the north pole. Balloons have risen to that gateway of the void—the stratosphere. Automobiles are chugging over the roads of darkest Africa. Yet the world of the ocean bottom, comprising almost seven tenths of the area of the earth, is still the stronghold of the unknown.

The blue surface of the sea is like an impenetrable wall behind which moves a vast pageant of life of which we know little. On the floor of the ocean, there are gold deposits, volcanoes, oil pockets, new and untapped sources of wealth.

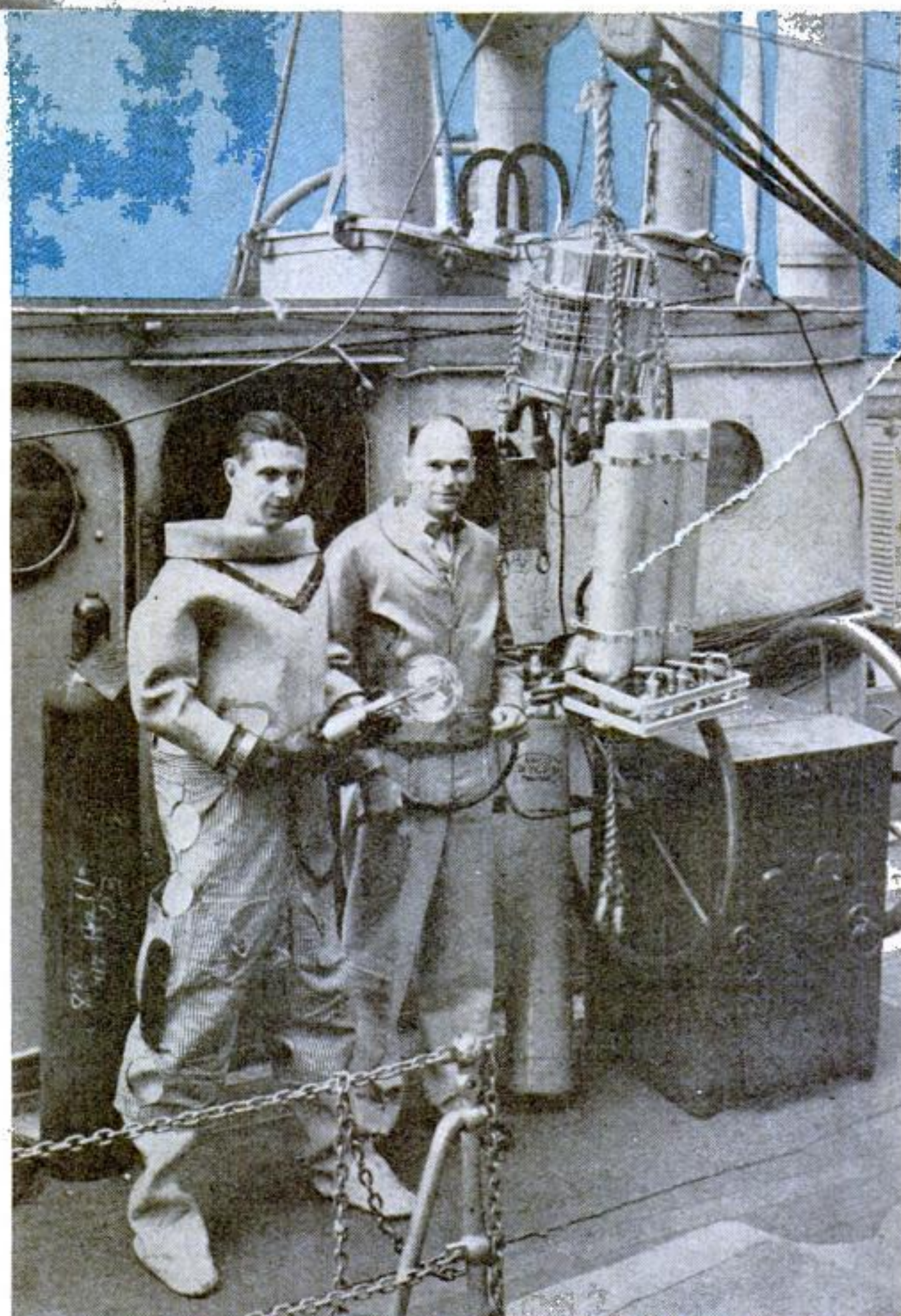
depths of Lake Michigan, and, finally, in U. S. Navy pressure chambers at Washington, D. C. Unlike the conventional diving suit, their 288-pound outfit requires no air line. High-pressure tanks, strapped to the diver, supply the needed oxygen. On a tiny instrument panel within the suit, dials will indicate the depth, the pressure, the temperature of the water, and the amount of oxygen remaining in the tanks. During descents, a built-in microphone will connect the diver with the mother ship, while a 4,000-candlepower lamp, will illuminate the depths.

These lamps were specially designed for the work by General Electric engineers. They are waterproofed with heavy rubber and are able to withstand pressures of 500 pounds to the square inch, more than three times that encountered at the 312-foot depth where the *Lusitania* sank on May 7, 1915, after being torpedoed by a German U-boat. Cooled by the deep-sea water, the lamps will have a life of approximately twenty-five hours. In the open air, their intense heat would burn them out in a few minutes. Twelve 20,000-candlepower lamps, filled with nitrogen and argon, will be mounted on a special submarine stage to provide illumination for the undersea cameras.

Coöperating in the salvage venture is a British concern. Its divers will descend in 900-pound "Tritonia" suits, articulated shells of superstrong alloy which protect them from the terrific pressure of the ocean bottom and enable

them to work for as long as ten hours at a stretch, even eating their meals from tiny, breast-high shelves within the suits. Laboratory tests have indicated that such outfits can function 2,400 feet below the surface. Because the pressure does not change within the alloy suit, divers can be pulled straight to the surface. They can come from the *Lusitania's* depth in three minutes, as opposed to two hours for an ordinary suit, in which frequent stops must be made for the diver's system to become accustomed to the change in pressure.

It was in a Tritonia suit that Jim Jarratt, a British diver, reached the hull of the sunken liner in the fall of 1935, establishing its exact location off Old Head of Kinsale, Ireland. Now, with the latest aids of science, undersea adventurers are returning for the \$15,000,000 worth of bullion, currency, and jewelry

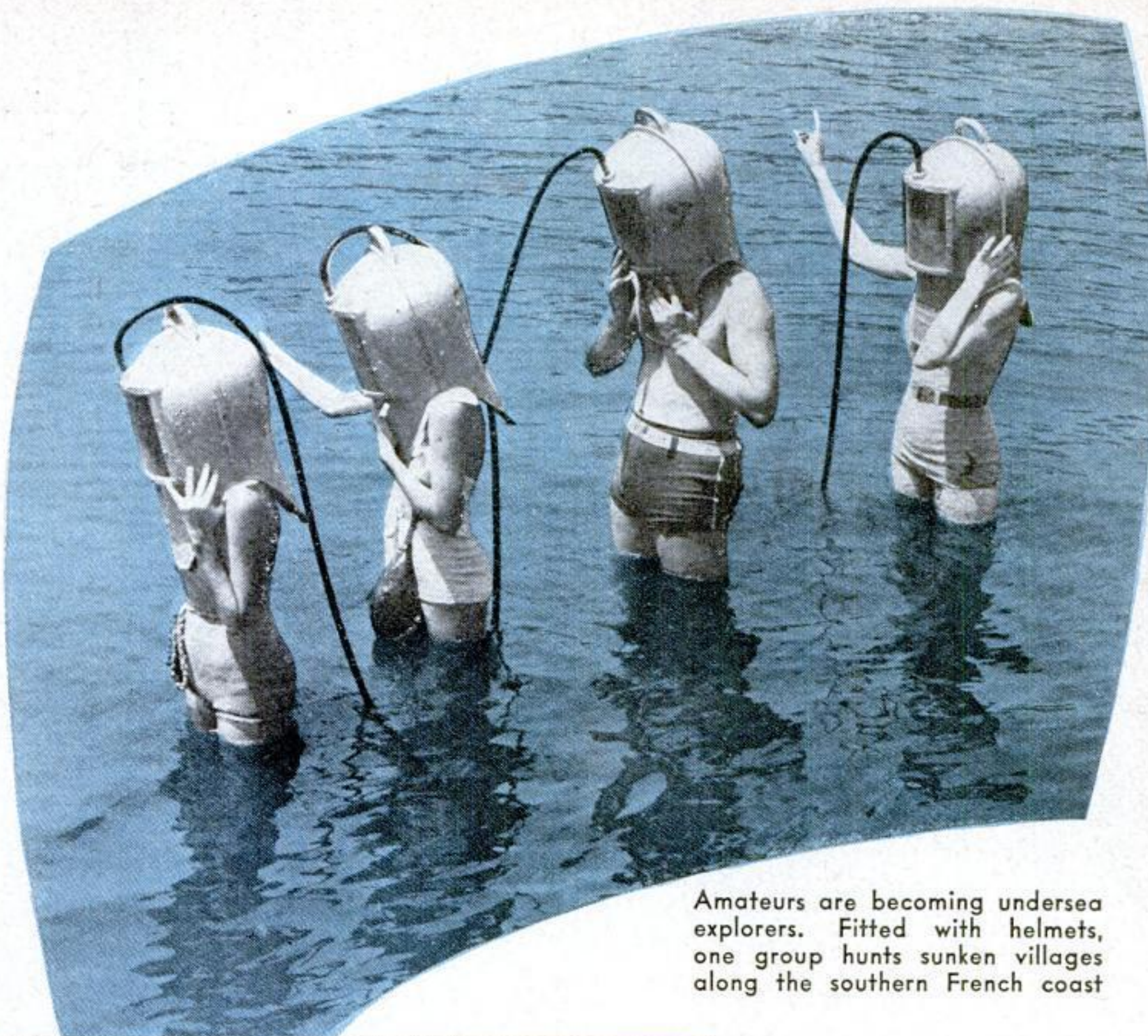


Capt. John D. Craig and Max E. Nohl about to test the equipment with which they will work 300 feet under water

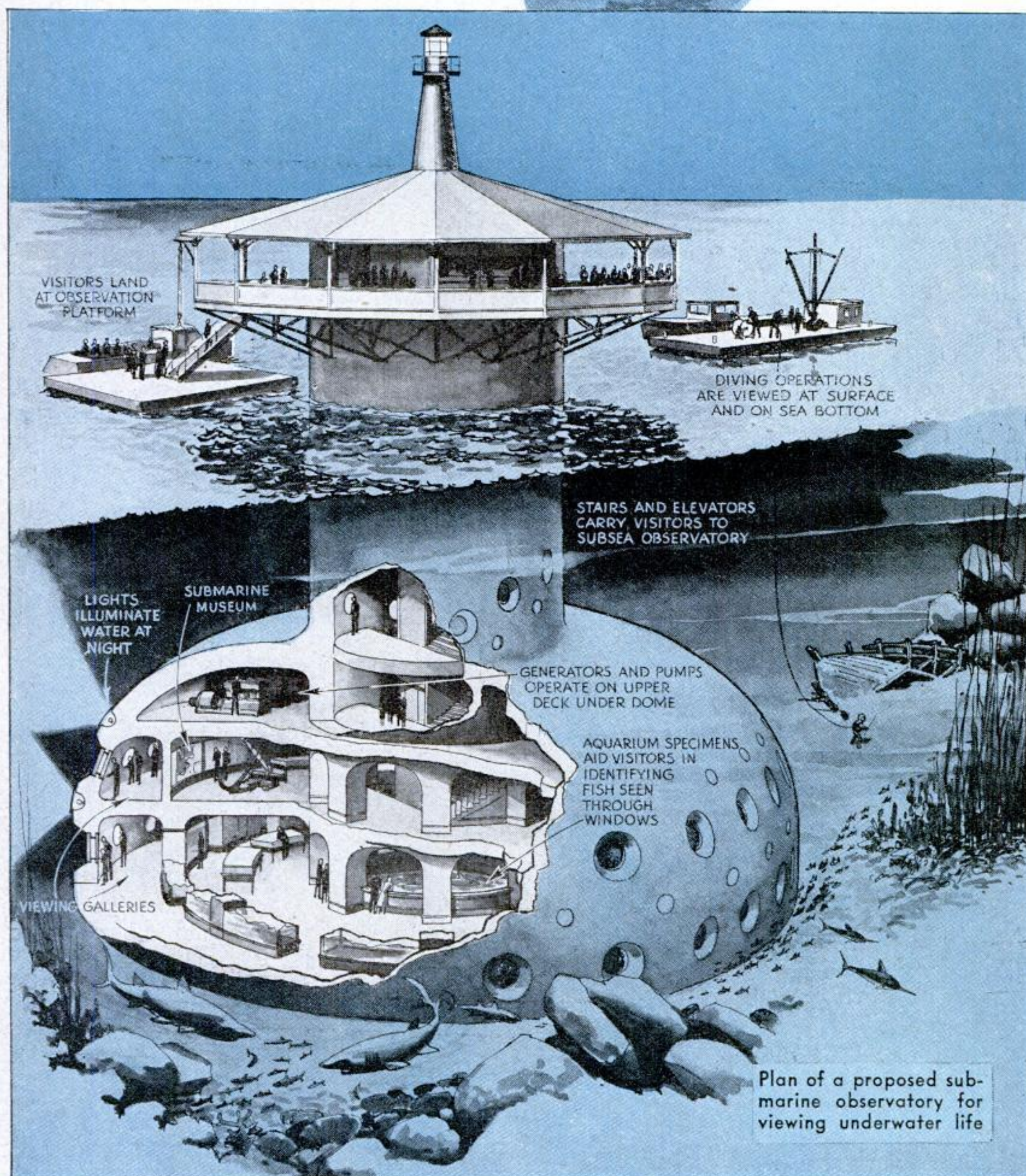
Wars of the future may be fought in these dim depths. So far, however, only Dr. William Beebe and his companion, Otis Barton, riding within the hollow steel ball of their bathysphere, have entered that fantastic world which lies half a mile below the surface of the sea.

Peering out through quartz windows, as their *Santa Maria* of the deep dropped lower and lower, they glimpsed bizarre creatures—clouds of luminous shrimps; flying snails propelling themselves through the water on leathern wings; fish with phosphorescent wings and tails; orange-lighted squids; constellation fish adorned with luminous golden spots surrounded by purple lights; unknown creatures of the deep that produced sparks as big as pennies, sparks that glowed for an instant and disappeared. This blue-black world of luminous inhabitants is a realm of research intriguing to science.

One interesting line of attack upon its many mysteries is foreseen by Dr. Beebe. Just as astronomical observatories are erected on mountain tops, he believes that chains of submarine observatories will be constructed on the floor of the sea. Giant mushrooms of steel, glass, and concrete, they will be reached by stairs and elevators from a landing



Amateurs are becoming undersea explorers. Fitted with helmets, one group hunts sunken villages along the southern French coast



Plan of a proposed submarine observatory for viewing underwater life

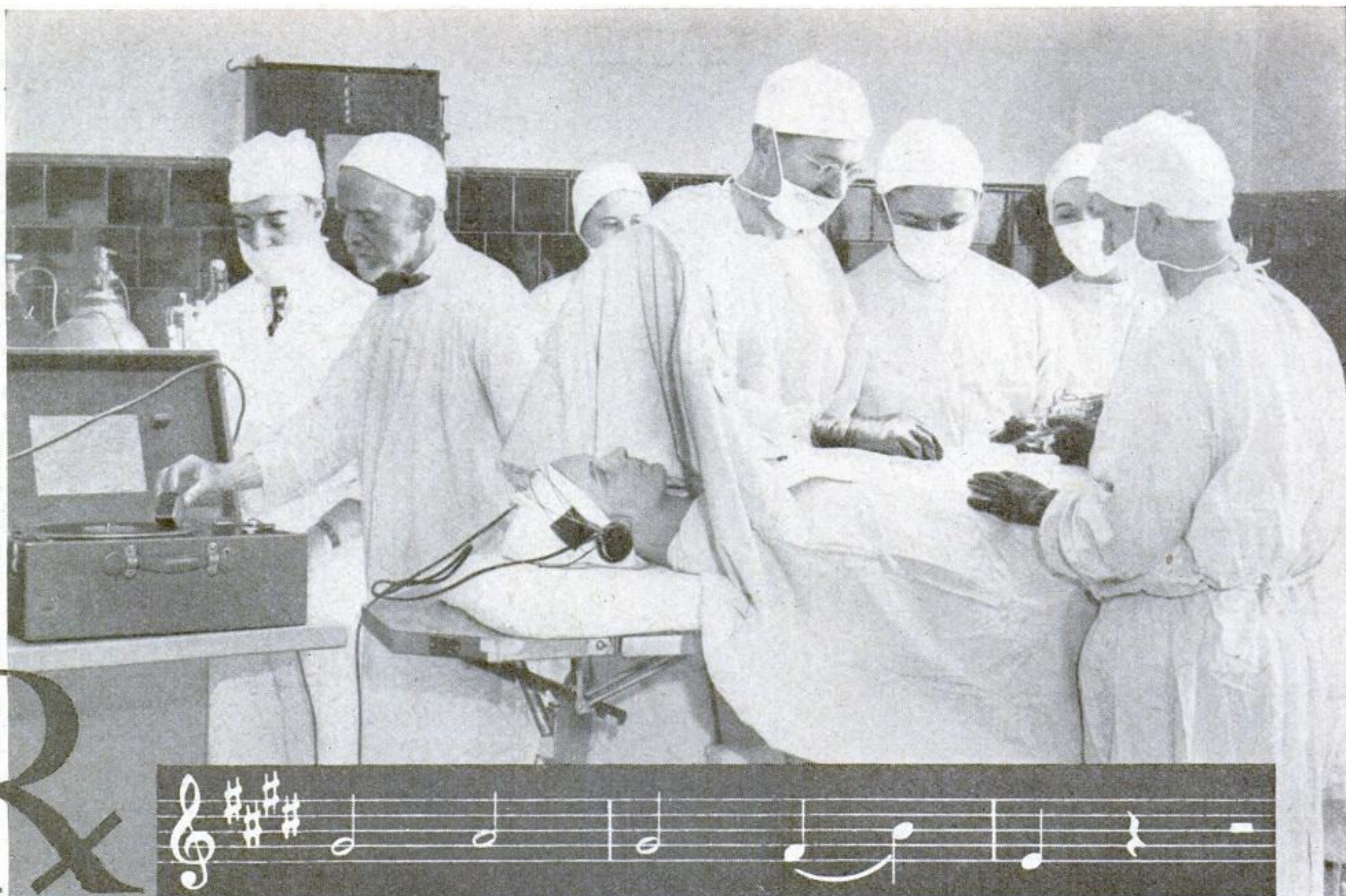
stage at the surface. Here scientists will conduct year-round researches, and visitors will glimpse a wonder world now virtually unknown.

Imagine yourself descending into one of these submarine lookout posts of the future. A quick descent in an elevator transports you into another realm almost as strange as if you had made a trip to Mars. The submarine building in which you find yourself has laboratories for scientific research, museums for underwater curios—but, most interesting of all, batteries of quartz-glass portholes that look out on the life of the ocean floor.

You glance through window after window at an endless panorama of action. Creatures of the sea bottom parade through coral forests and among waving tapestries of seaweed. Jelly-fish go throbbing by in schools. A shark slides past within a dozen feet of your window. You peer upward and see great fish gliding like planets across your watery sky. Curious creatures of the deep bump their noses along the glass of your window, looking in. At night, searchlights send their pencils of brilliance weaving back and forth through the water, glinting on the sides of nocturnal prowlers.

By locating such observatories in sheltered spots
(Continued on page 135)

A patient undergoing an operation with a local anesthetic while listening through earphones to the strains of music played on a phonograph. Rhythm and melody have been found to have a quieting effect on the sick



How Music Heals the Sick

BEETHOVEN'S Moonlight Sonata—three times a day. That is how doctors' prescriptions may read in the near future, according to reports from the world's leading medical centers. For in laboratories, hospitals, prisons, and mental clinics, research experts are uncovering strange facts that throw new light on the weird effects of music on our physical and mental health.

Just recently, for instance, Prof. S. V.

Kravkov, a Russian scientist, discovered that music and similar sounds can even improve a listener's eyesight as much as twenty-five percent. As little as the rhythmic ticking of a clock, experiments showed, served to stimulate the vision. A practical application of the discovery, the Soviet professor points out, is expected to serve as an aid to astronomers, microscopists, engravers, and others whose work depends on the strength and accuracy of the eyes.

Even more astonishing, however, are

tests being carried on in this country. Not long ago, Moissaye Boguslawski, famous pianist, conducted a series of novel experiments in a Chicago hospital for the insane. Seated before an Italian mother so mentally deranged that she refused to look at her young baby and demanded that she be treated like an animal, Boguslawski played a group of Italian melodies ranging from nursery tunes to folk songs. The woman showed no reaction until he began an aria from the opera "Il Trovatore." Before he had finished, the patient began to weep and begged attendants to bring her baby to her.

One authority reports the case of a woman who accidentally discovered that by listening to certain types of music she could control her periodic spasms of epilepsy. Once, when she felt an attack coming on, a friend started to play the piano. To her amazement the spasm failed to develop. Now, whenever she feels the approach of the telltale symptoms, she takes a "dose" of music, and has never had a serious attack since she made this discovery.

Psychiatrists, surgeons, dentists, and other experts are using music in many odd ways, and with astonishing results. Dr. L. S. Bender, of Bellevue Hospital in New York City, reports cases of mentally deranged children whose fits of violence have been quickly ended by music. Dr. A. F. Erdman of the Brooklyn Eye and Ear Hospital, has quieted patients being operated on under a local anesthetic, by having them wear earphones and listen to the recorded strains of some musical selection. A

Savages know the practical value of music. Here some Zulu women, led by a tribal chieftain, are performing an exciting war dance



PHYSICIANS, SURGEONS, AND MENTAL SPECIALISTS FIND THAT MELODY HAS WEIRD EFFECTS ON PHYSICAL HEALTH

By E. W. Murtfeldt

number of dentists are using this method to drown out the noise of the drill and overcome the tenseness and fear of nervous patients. And in one instance on record, a man rejected a local anesthetic in favor of music played by himself on a harmonica, while surgeons probed for a bullet lodged in his thigh.

Students of musical therapy do not agree as to the exact way in which music affects us. Some believe that sound vibrations have a direct physical effect, while others see a connection only through nerves and emotions. Dr. George W. Crile, the great surgeon, attributes music's medical value to the fact that a great many diseases are caused by strained emotions—worry, fear, or intense excitement. Music, he believes, relieves this nervous tension, and thereby contributes to the patient's recovery.

Few deny the enormous power that music can exert, although certain musical instruments and musical selections may cause different reactions in different people. Thus, while the steady beat of a drum may soothe some people, it excites others. The throaty moan of an oboe has been known to make a person temporarily insane, slow chants often have a hypnotic effect, and a lullaby has more than once quieted a serious heart flutter.

William van de Wall, Holland-born American expert on musical therapy,

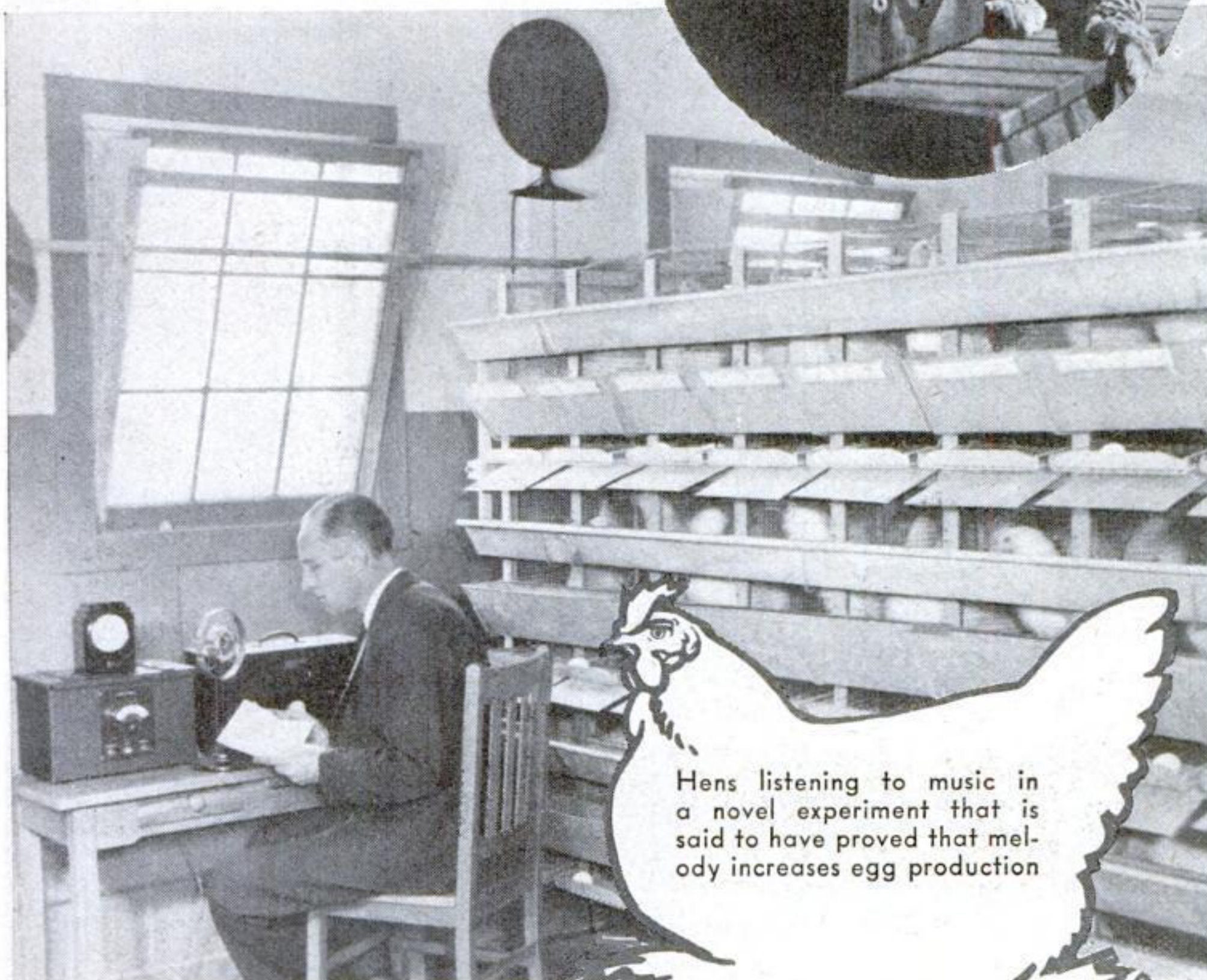
Snake charmers use music to tame dangerous reptiles. Below, a leopard cub is being soothed by playing melodies



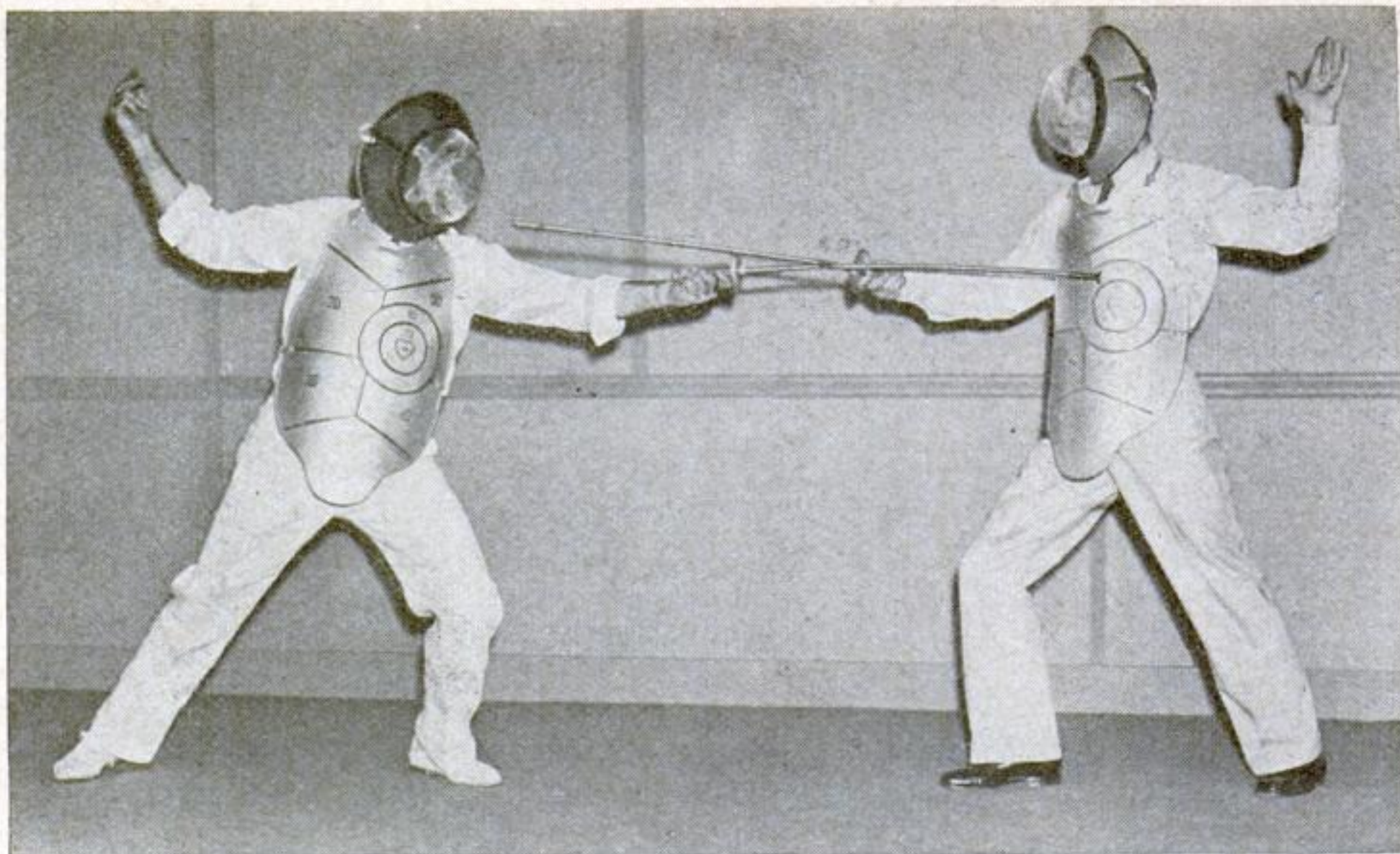
has for years been demonstrating the beneficial effects of music in the treatment of rebellious prisoners and dangerous maniacs. On one occasion, he walked boldly into the violent ward of a mental hospital, armed only with a small portable organ. One patient, a tall, powerfully built man who had to be constantly watched, proved to have an excellent voice, and began to sing along with the organ. Soon, he was promising to control himself if allowed to sing once a week. Within a few months, he was moved out of the violent ward, and finally he was dismissed from the hospital, a man restored to sanity through music.

Music is even invading industry. Realizing that rhythm and melody can counteract boredom and monotony, many manufacturers have installed sound systems in their plants to keep up the morale, support the vitality, and increase the efficiency of their manual workers. In London, recently, two experimenters discovered that during the time a phonograph played light orchestral music, the output of 355 packers in a cracker factory increased eleven percent.

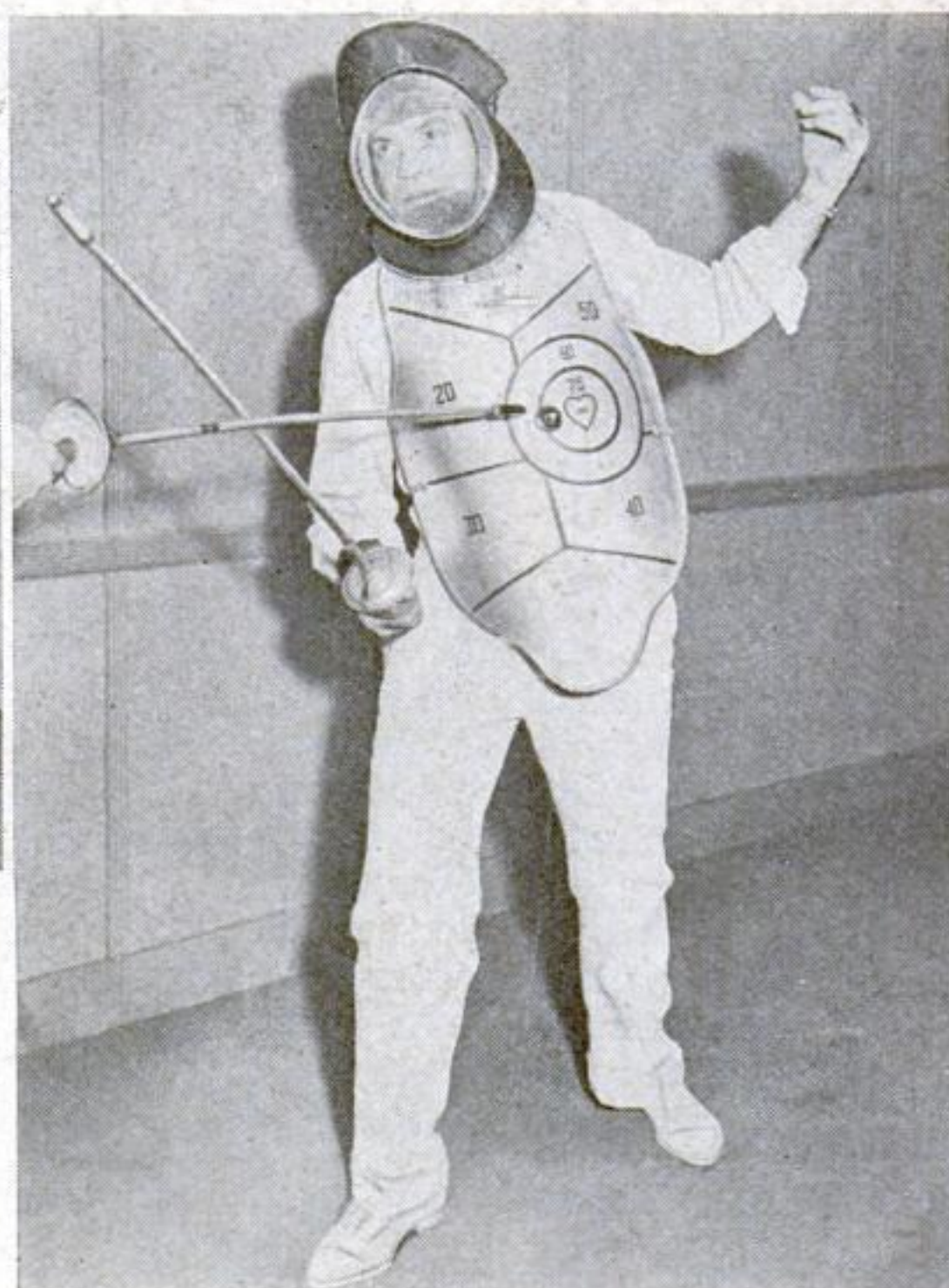
Thus, music is being used as a practical aid in treatment of mental quirks and physical ailments, and as a potent stimulant to working efficiency. So enthusiastic is one expert over the possibilities of musical cures, that he prophesies the day when the portable phonograph and a kit of selected records may become as indispensable to the family physician as the stethoscope and bag of common medicines.



Hens listening to music in a novel experiment that is said to have proved that melody increases egg production



Fencers using foils with vacuum cups fixed to the tips. The close-up below shows how a tip sticks to the shield to mark a touch



Vacuum Cups Keep Score for Fencers

VACUUM CUPS of rubber fixed lightly to the ends of foils are a feature of a novel fencing outfit just introduced. The tiny cups come loose and stick to an opponent's protective shield at the point where they touch it. The tips not only

insure safety for the fencers, but facilitate scoring by adhering to areas appropriately marked on the shields. Scoring is based on the location of the touch, a thrust at the heart counting most.



This aerial nursing corps is ready to fly anywhere in airplane-ambulances

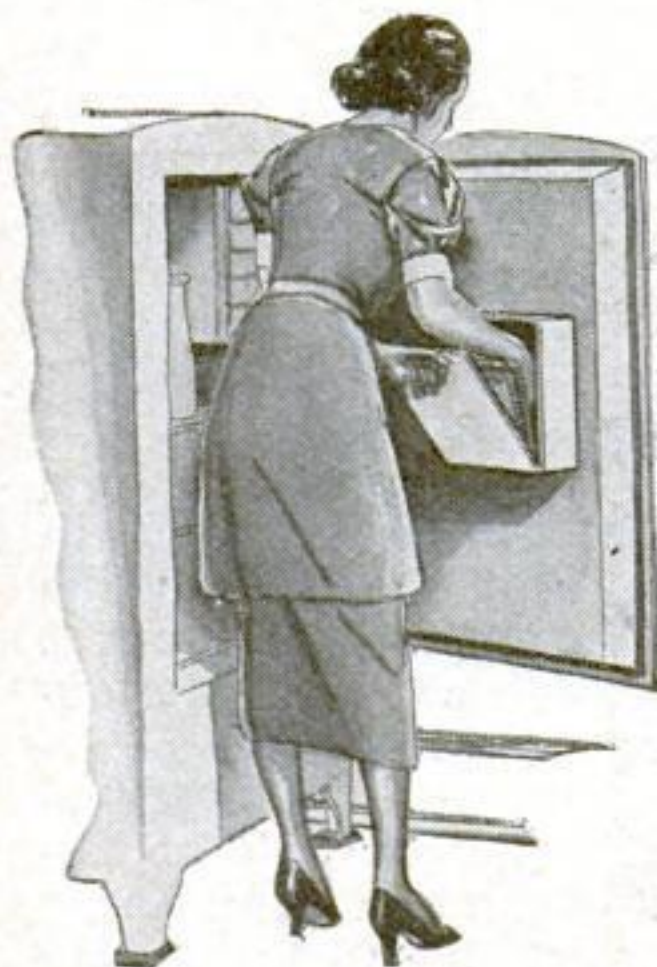
Ambulance Plane for Nurses Answers Emergency Calls

USING specially equipped ambulance planes, an aerial nursing service recently established in California answers emergency calls for medical assistance. A group of the flying nurses is shown, at the left, standing before one of their ambulance ships.

Road Roller Levels Bumps

HUMMOCKS as well as bumps in a newly laid road are quickly leveled by a steam roller of new design. The machine's weight automatically shifts to a supplementary central roller when uneven spots are encountered.

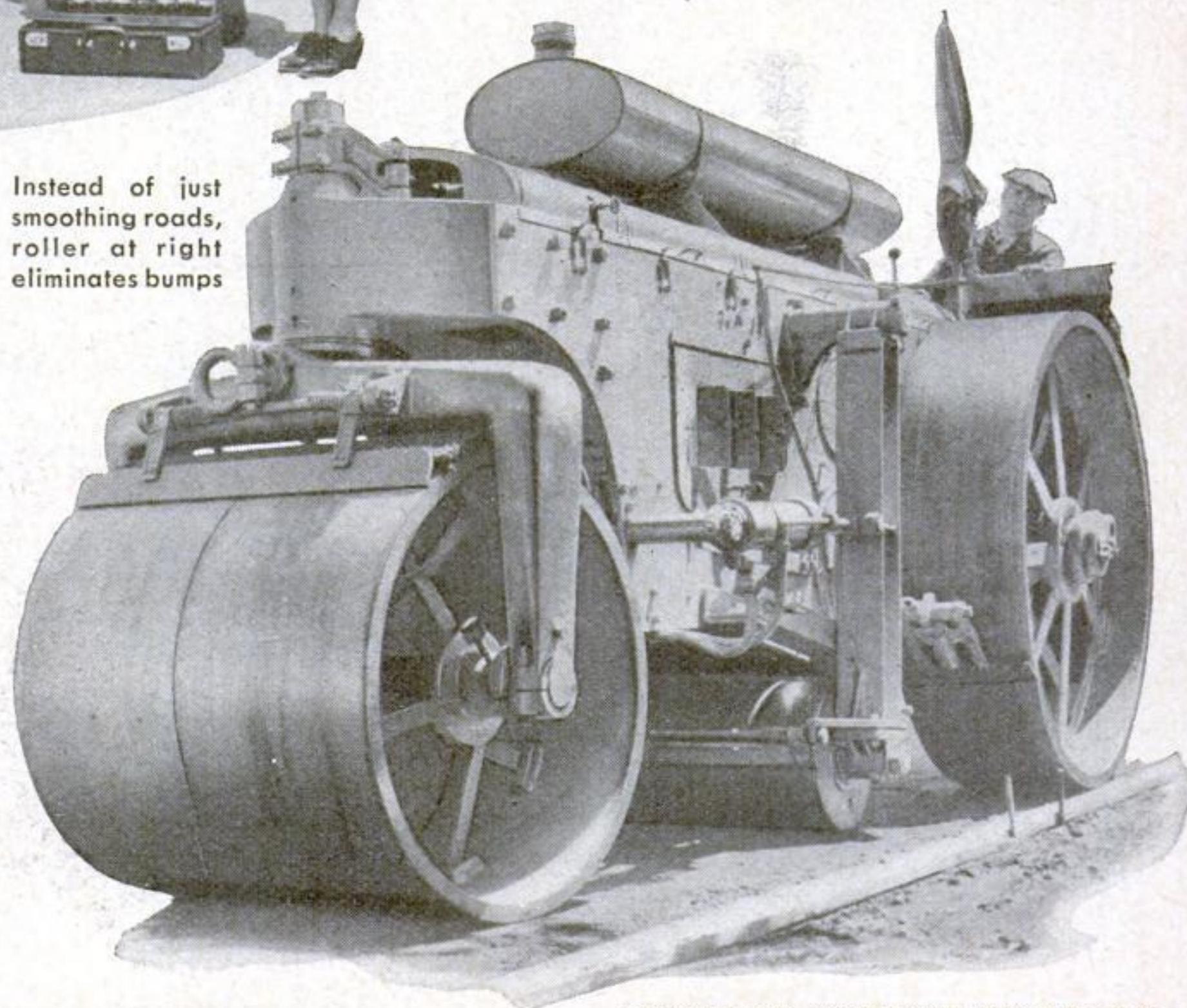
Icebox Safe Protects Jewels



New icebox safe provides a safe-deposit box for homes

A NOVEL SAFE for the protection of jewelry, silverware, or valuable papers in the home is built into a mechanical refrigerator. The metal strongbox, fitted with either a key-type or combination lock, is bolted to the inner face of the icebox door. Because of its metal construction and its position within the heat-insulated refrigerator, the safe is said to be completely fireproof. The safe's position makes it unlikely that burglars would find it.

Instead of just smoothing roads, roller at right eliminates bumps

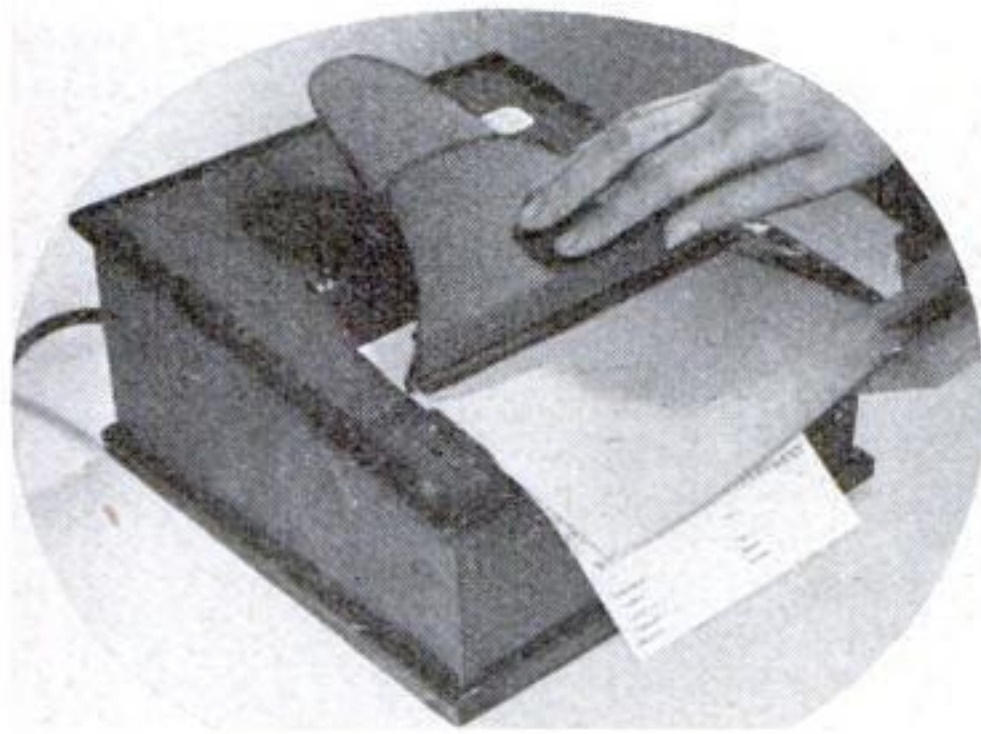




Game Is Played with Live Beetles

LIVE BEETLES scamper across the playing board of a new game devised by a Pasadena, Calif., inventor. At the start, the beetles are released from a corral in the center of the board, which is surrounded by a three-inch transparent

fence. Four cages in the form of celluloid cylinders are raised or lowered by players who operate levers under the table. Scoring is based on the number of beetles trapped in the cylinder by each of the players.



This machine records a customer's name on the negative and positive, as shown below



New Negative Marker Identifies Photos

WITH a new darkroom device, commercial photographers can easily mark their negatives for later identification. The original order form for a picture is clamped into the box-shaped apparatus and the undeveloped negative placed over it. Pressing the clamp flashes on a light that projects the writing on the order onto the negative, as shown above.

Clips on Hiker's Cane Support Picnic Dishes

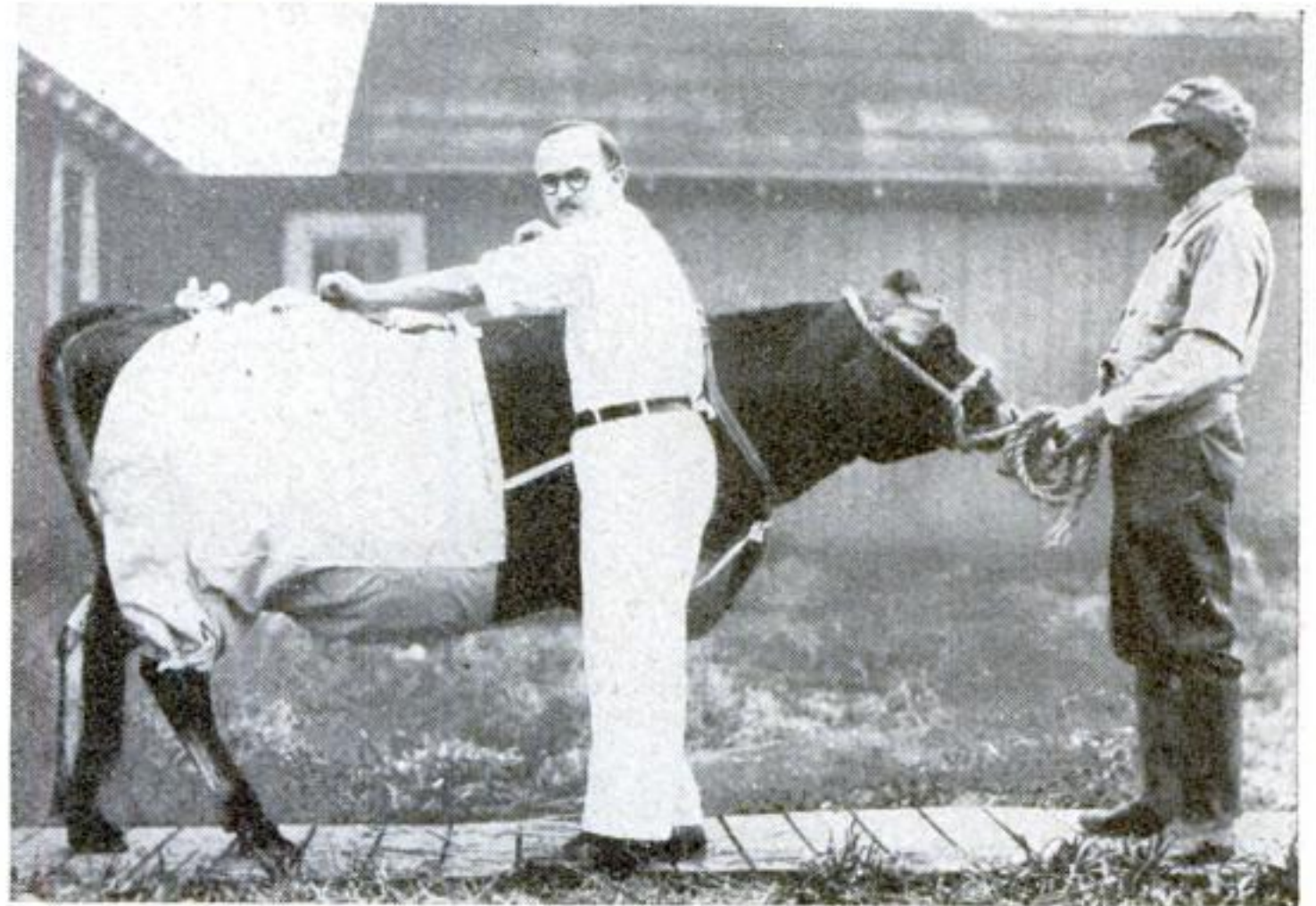
SMALL clips, invented by an Englishman, can be attached to a walking cane to make a novel picnic table. The cane is stuck upright in the earth, and the clips hold plates away from ants and other insects on the ground.

Brackets hold the dishes out of the reach of insects



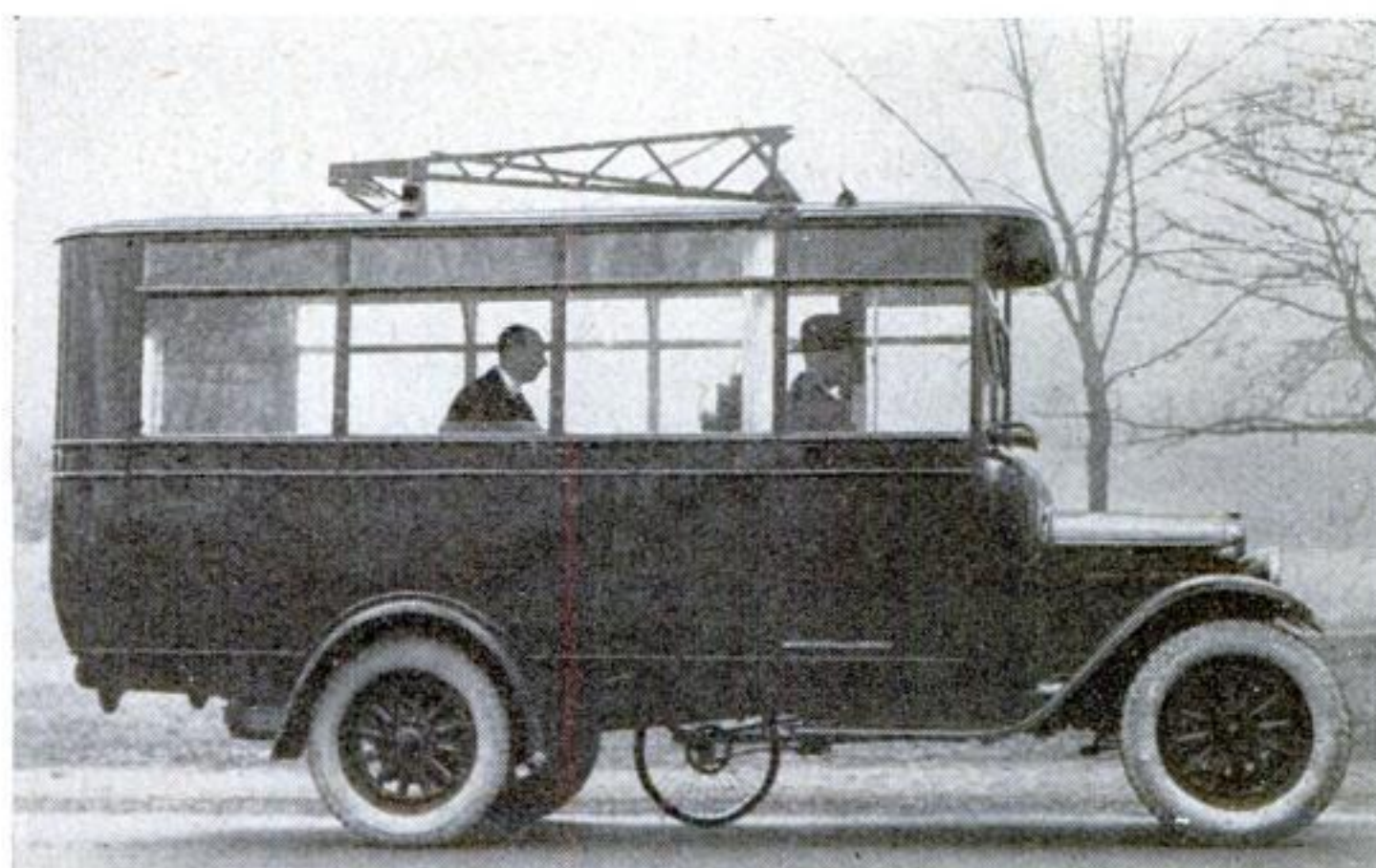
Cows Wear Pants As Aid In War on Insects

SCIENTISTS now are dressing cows in pants. Strapped onto the hind quarters of a cow, as shown in the photograph at the right, the odd cattle trousers are used to collect specimens of ticks and other insects. These are sent to laboratories where extensive research is being made into the best methods for combating the unsanitary and annoying insect pests.



A farm expert adjusting a pair of the insect-collecting pants

Odd Car Helps Chart Bus Routes in London



The roof-top gauge is used to check bus clearances under bridges

PROPOSED bus routes and extensions of existing lines in the environs of London are surveyed with the odd vehicle shown at the left. A fifth wheel on the bus actuates distance-measuring apparatus to establish the exact length of the new route, while clearance under low bridges, and overhanging tree branches is checked with a hinged metal arm on the roof.



This ancient game, ancestor of billiards, is played with hooped cues

Ancient Lawn Billiards Gains New Popularity

ONE of the most ancient games in the world, "Jeu-de-Mail" or "Pell Mell," the ancestor of modern billiards, is being revived by English players. Played on a grass court, the game employs large wooden balls which are knocked through a metal ring with wire loops attached to long poles or cues.

African Boy Races In Derby

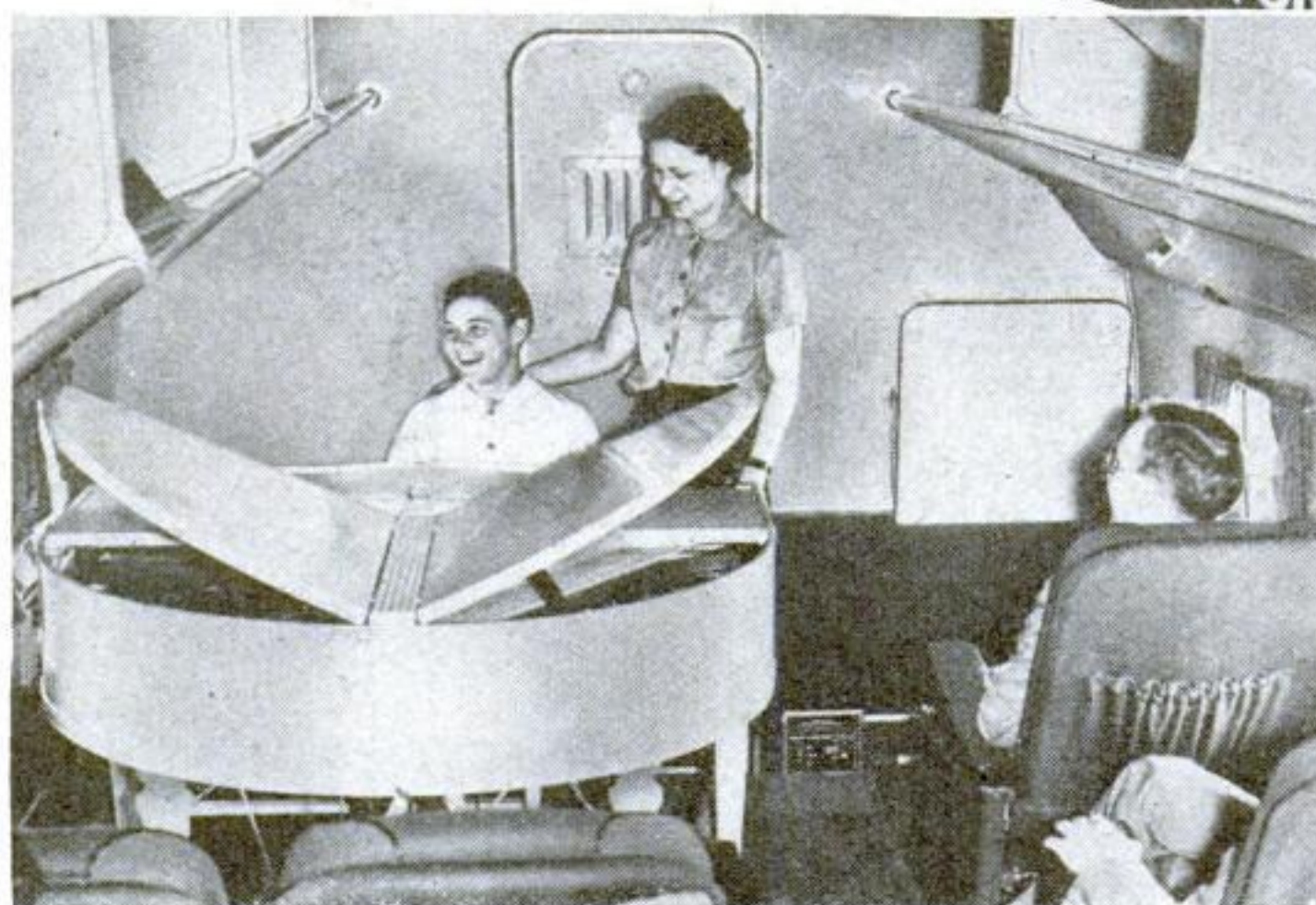
FROM his home in Port Elizabeth, South Africa, fourteen-year-old Dannie Wege made a 7,000-mile journey to the United States to participate in a recent soap-box derby held at Akron, Ohio. The South African champion is shown with his homemade car on its shipping crate.



The South African racer with his homemade car

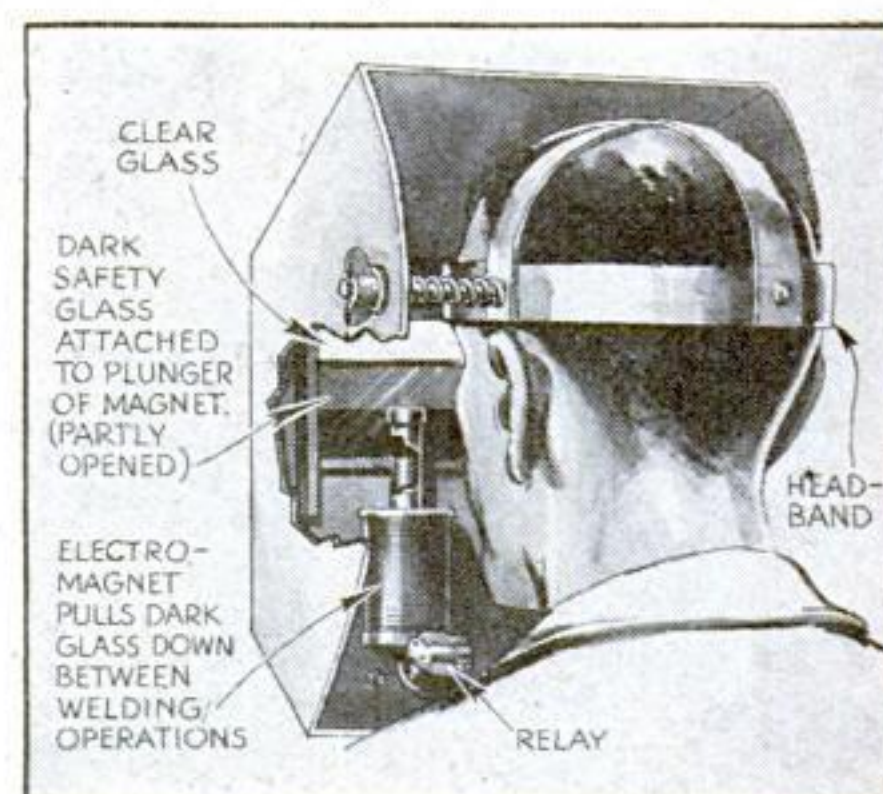
Piano Shipped By Airplane

SAID to be the bulkiest piece of freight ever transported by air express, a baby-grand piano recently was flown from Chicago to New York City. Too large for the transport plane's freight compartment, the piano was carried in the passenger cabin, where it was played by stewardesses during the trip for the amusement of passengers.

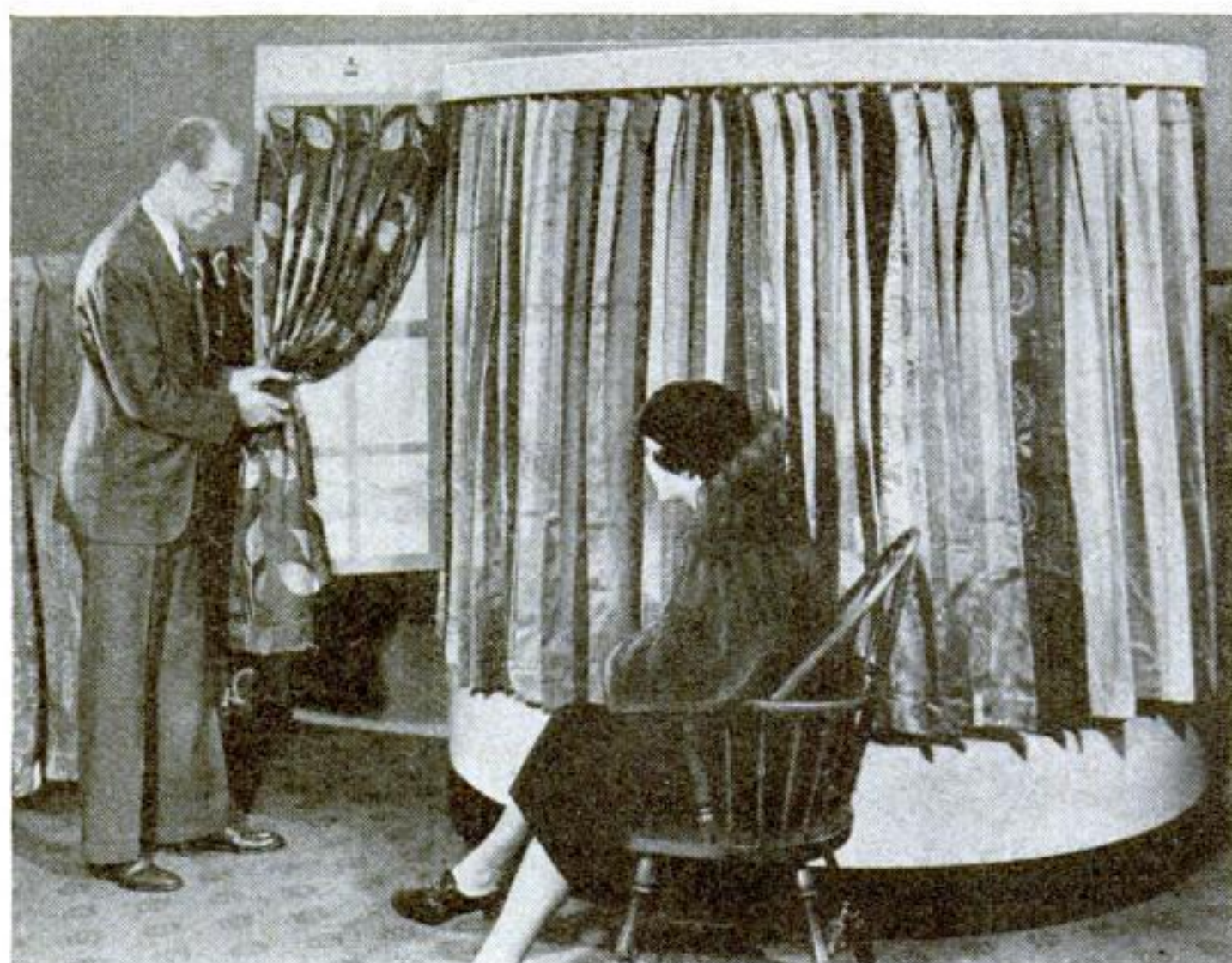


In the passenger cabin, the piano provided a source of entertainment

New Automatic Shield Guards Welder's Eyes



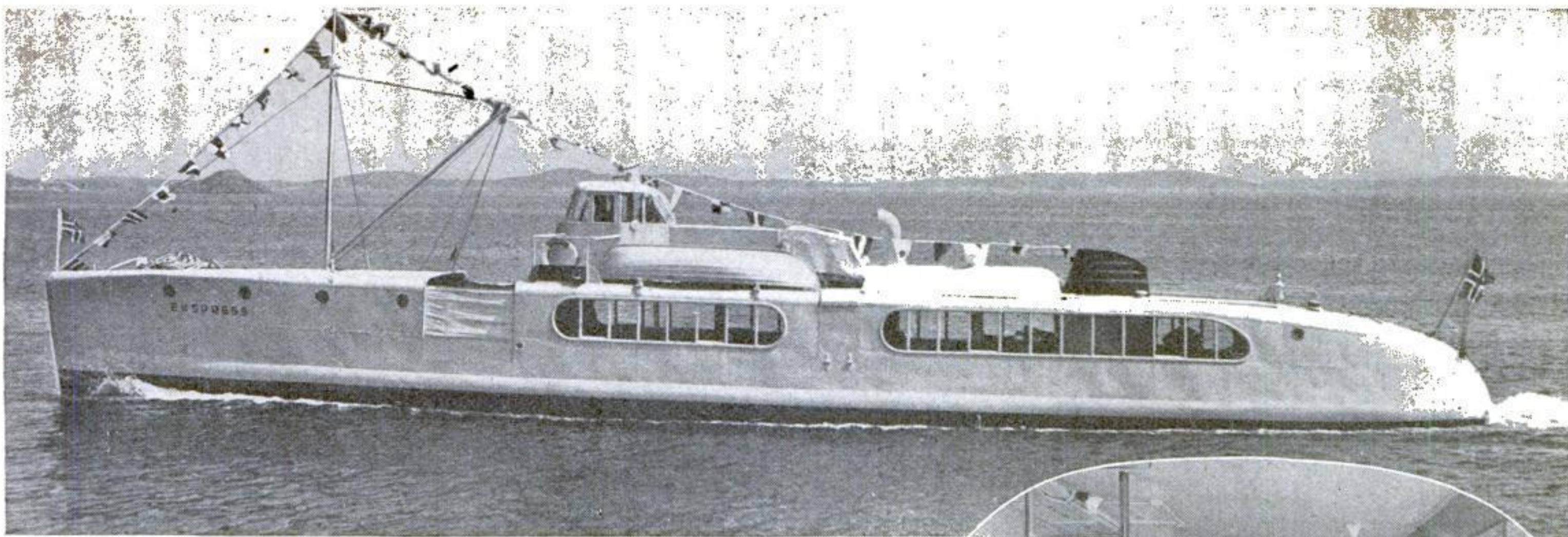
OPERATORS of welding machines are protected from harmful light radiations by an electrically controlled face shield that is said to be foolproof. Strapped to the head, the device has a movable shutter made of colored glass to filter out the dangerous rays emitted by the welding arc. The apparatus is wired to the electrical circuit of the welding machine so that the instant a spark appears, a spring snaps the protective shutter up in front of the eyes of the operator. When the welding equipment is not arcing, the glass filter is held out of the operator's line of vision.



A dummy window shows how curtain fabrics will look in actual use

Drapery Rack Shows How Cloth Looks on Window

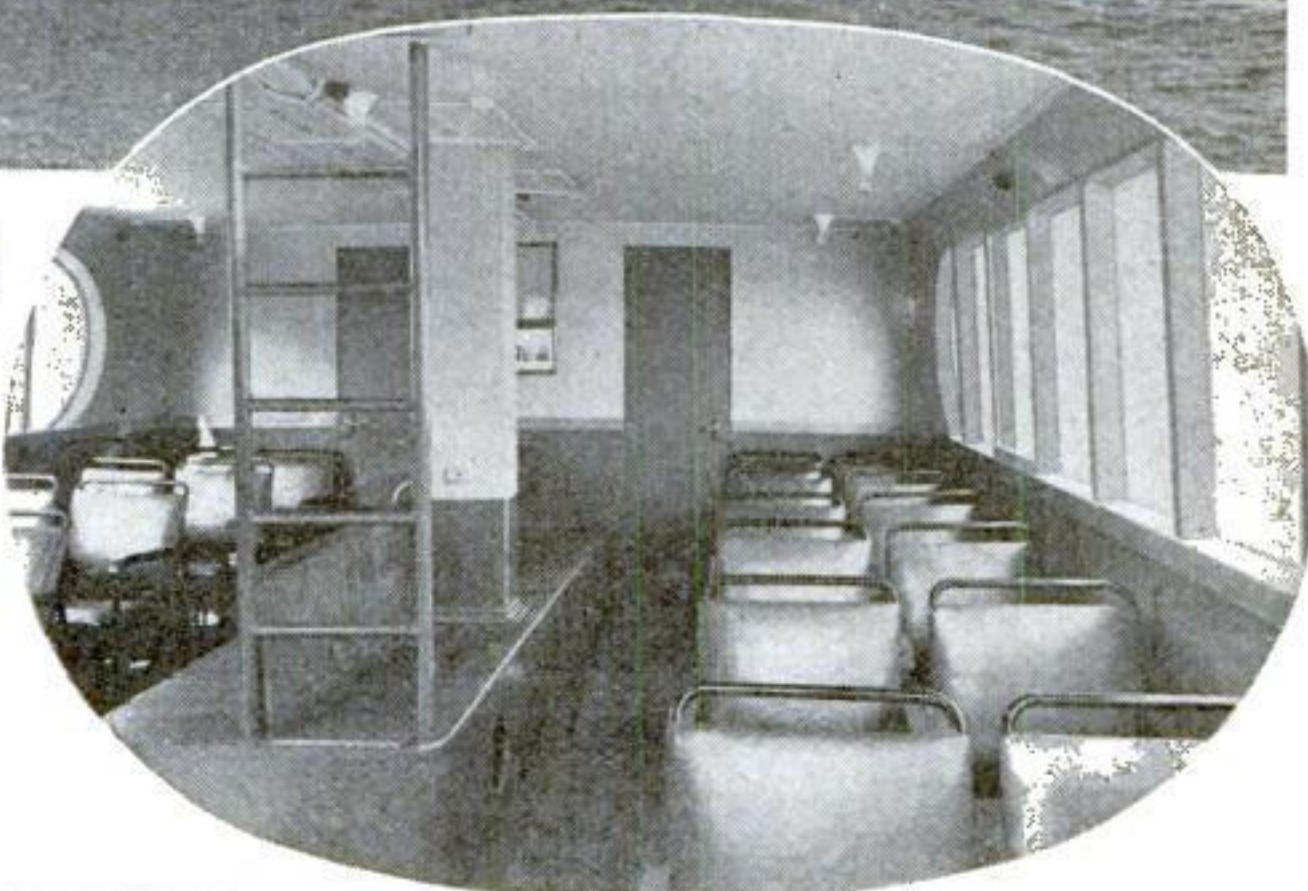
DRAPES and curtain materials are effectively displayed by a new device designed for use in retail stores. Individual samples in a circular rack are pulled out on separate tracks and draped over a movable dummy window frame, as in the photograph at the left. This shows the customer exactly how a material will look when in actual use on her windows at home.



Passengers, mail, and light freight are transported along the rugged Norwegian coast in this specially designed craft. The picture at the right shows the cabin

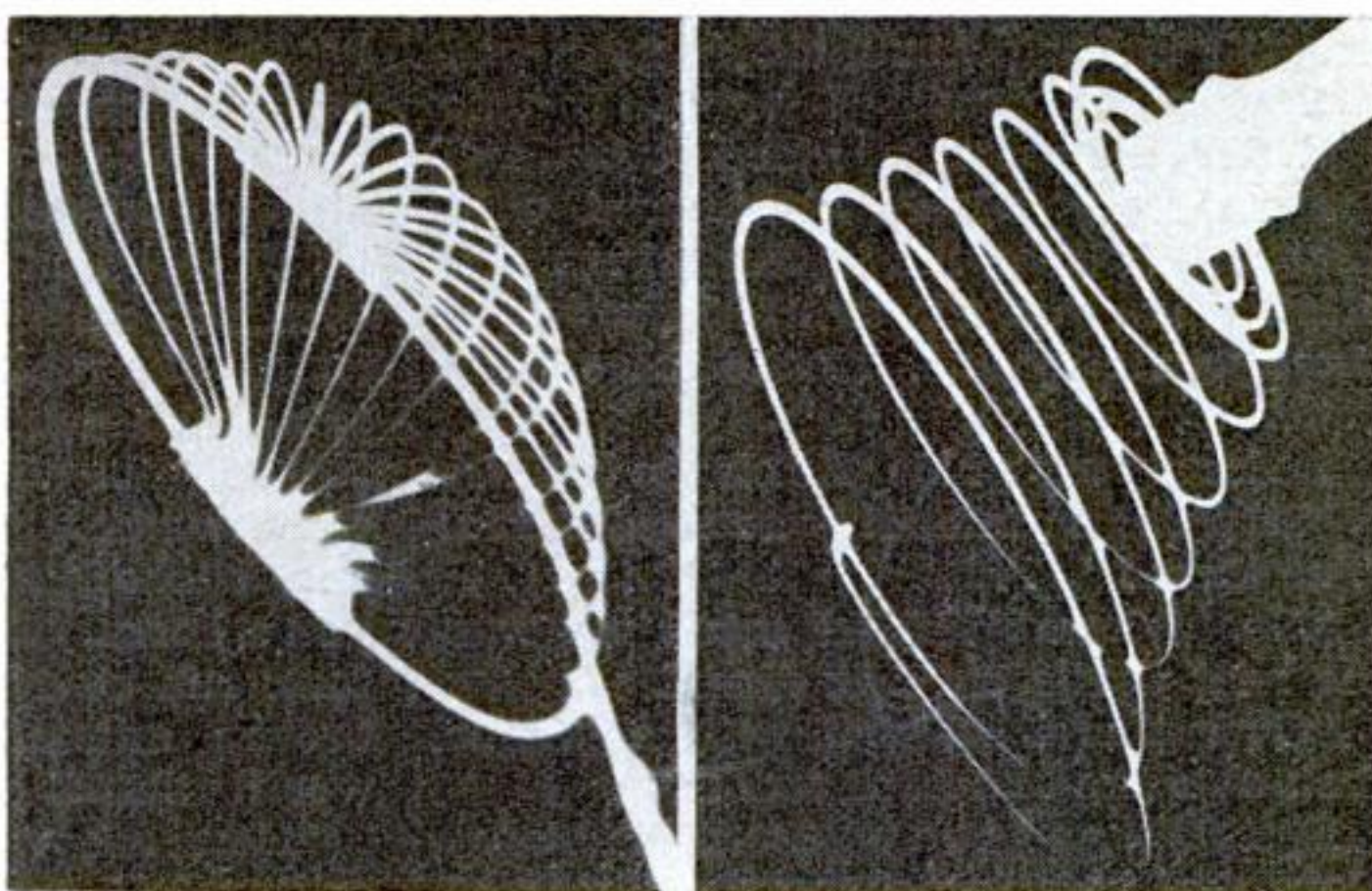
Fast Boat Navigates Fiords

DESIGNED especially to navigate the picturesque fiords of the Scandinavian coast, a sightseeing "water bus" of electrically welded, all-metal construction has been placed in service in Norwegian waters. Measuring 100 feet in length, the craft skims the water at a speed of thirteen knots, propelled by a six-cylinder motor. It carries 160 passengers, together with mail and light freight for points along the coast.



Kitchenware Photography

KITCHENWARE takes on fantastic shapes in interesting shadowgraphs that any home experimenter can make, simply by laying the objects on sheets of sensitized paper and letting light fall upon them. If blueprint paper is used, sunlight prints may be developed and fixed simply by washing in water.



Odd shadowgraphs of household articles made with sensitized paper. At the left is an egg beater, at the right a whisker

Spring Tricycle Frame Gives Smoother Ride

A spring-steel backbone replaces the rigid frame



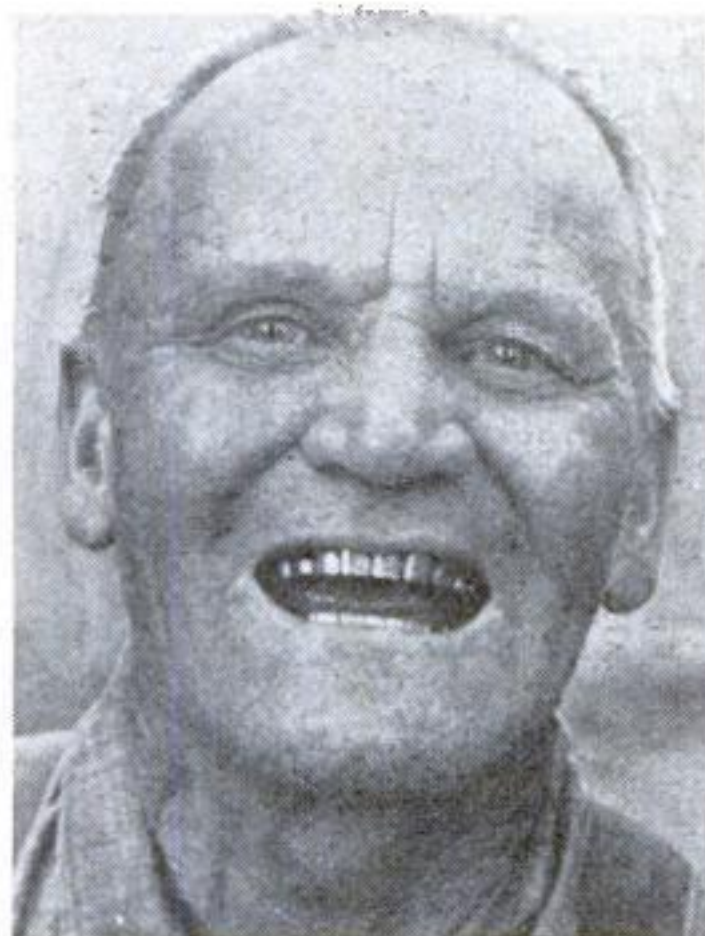
BUILT into a new velocipede for children, a resilient backbone of spring steel replaces the conventional rigid frame. The shock-absorbing member is said to minimize jolts and jars, giving a more comfortable and healthful ride.

River Tunnel Is Square

A NEW vehicular tunnel to be constructed under a river in Holland will be box-shaped instead of the usual round tube. The tunnel is to be built up on land and transported to its location, then sunk in place, saving the expense of a boring operation.

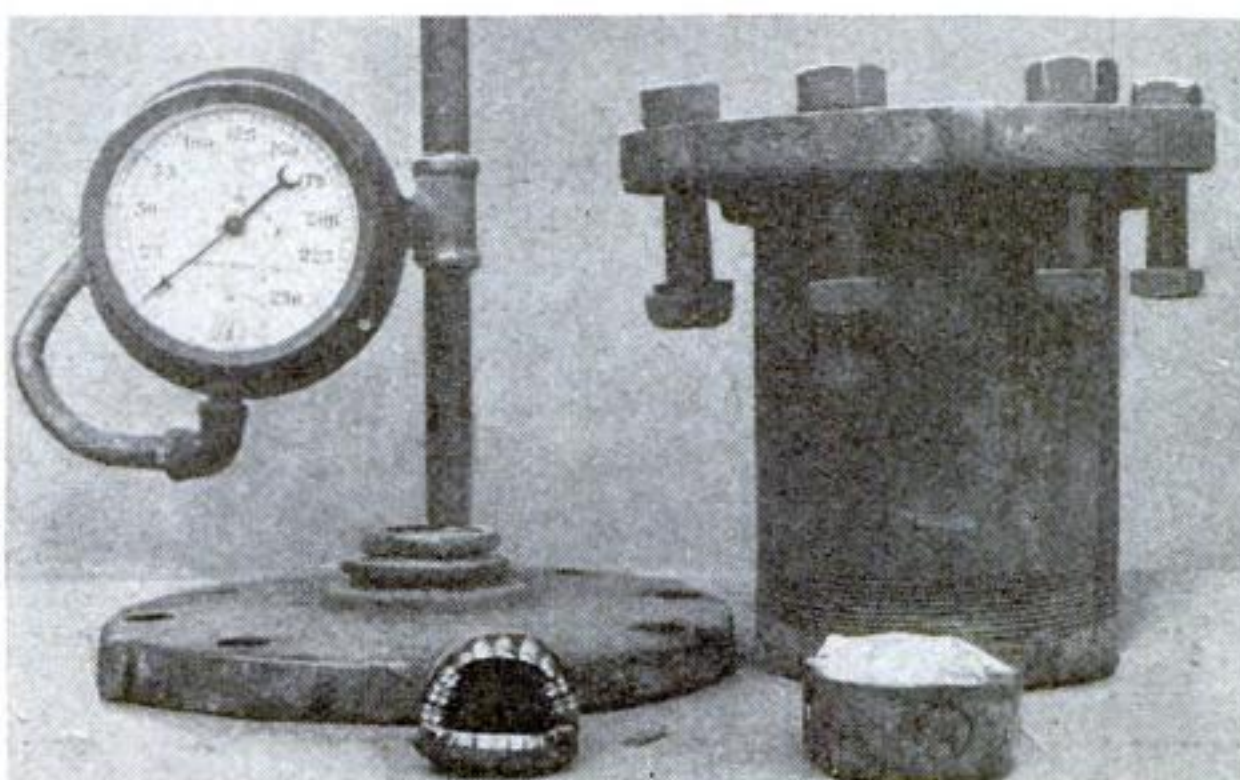
Makes Own False Teeth of Stainless Steel

FROM stainless steel, a Wilmington, Calif., carpenter has made himself a complete set of unbreakable artificial teeth. Buying a block of the alloy, he shaped each tooth individually with the aid of a hack saw and file. Then he vulcanized them into a homemade mounting of rubber, obtaining the material from a dental-supply house and making his own mouth impressions with paraffin. For molding purposes he employed plaster of Paris in electric outlet boxes.

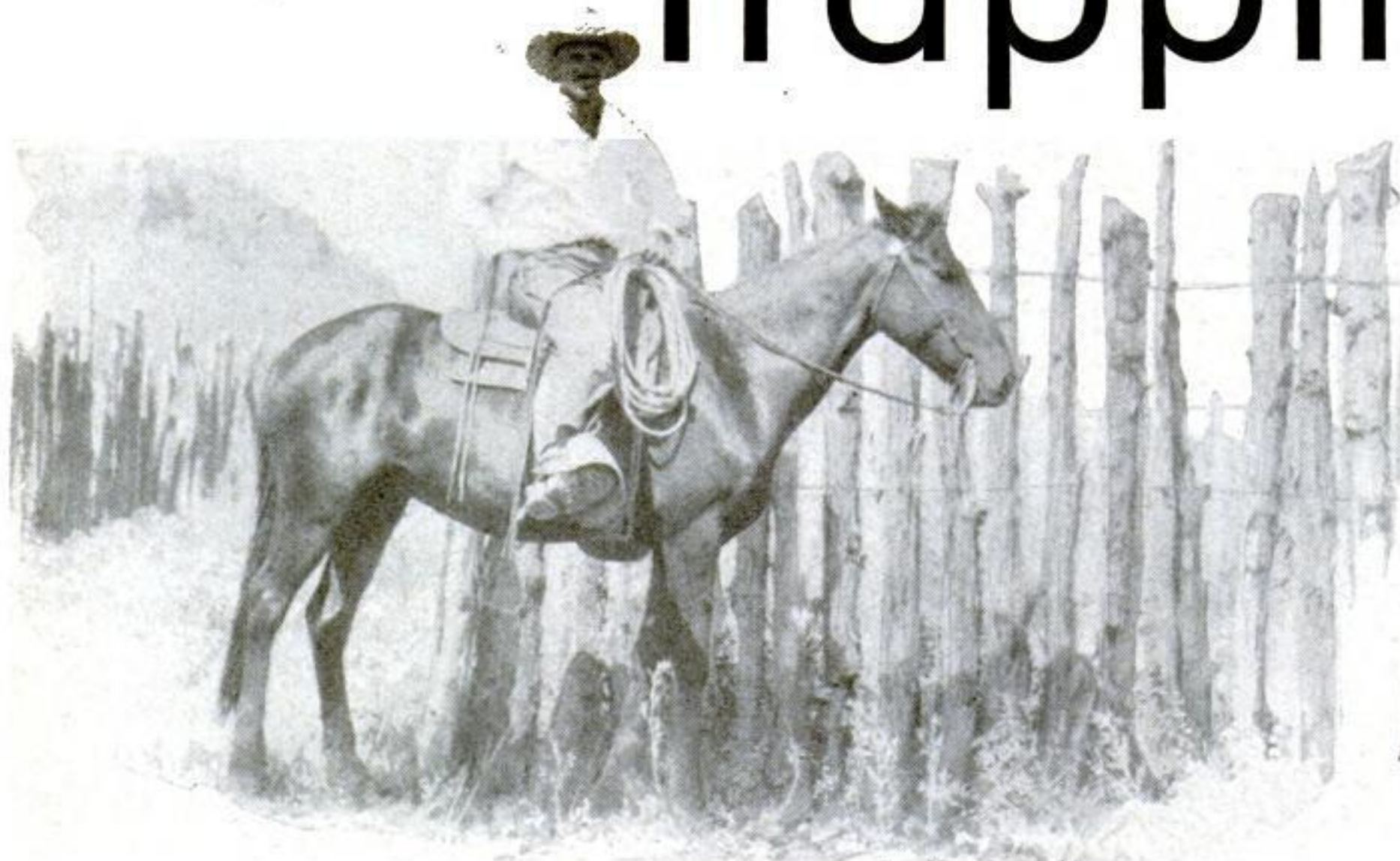


Anton Lee displaying the set of unbreakable false teeth he filed out of stainless steel

Vulcanizing boiler made from iron pipe, and electric outlet box used to mold plate



Trapping Wild



THE AUTHOR OF THIS EXCITING STORY TAKES YOU FOR A VISIT TO A CAMP OF MUSTANG HUNTERS ON THE ARIZONA DESERT AND LETS YOU SHARE THE BREATH-TAKING THRILL OF THE CAPTURE

OVER the short-grass desert of the Arizona Strip, a region of 5,000 square miles along the border of Utah and Arizona, wild-horse hunters are gathering a rich harvest of gold on the hoof. Spurred on by the high prices now being paid for horses by cotton farmers, they are trapping the mustangs descended from steeds brought to this barren country 400 years ago by the Spanish.

What interested me in this thriving new business, however, was not the handsome profits that are being made in it, but the sheer thrill of the capture. Sitting beside a desert water hole in the night, listening for the clop-clop of hoofs as the wild herd thunders out of the darkness, and springing the trap on a score or more of frantic horses, is an experience to send shivers down the spine of the most hardened hunter of big game.

So when Roy Wright told me about the mustang hunters, one night beside a camp fire in the Kaibab National Forest, nothing would satisfy me but a visit to one of their lonely camps and an actual try at the sport.

"We'll go to Baldy Waters's camp at Flattop," Wright told me. "He'll have saddle horses for us there."

We left Moccasin, Ariz., in a rickety old automobile load-

ed with bedding, grub, riding gear, and a fifty-gallon drum of water. It was hot. The thermometer stood at 105, and the flat, dry desert shimmered with heat waves that magnified things and often made you see two objects where there was only one. Roads there were none.

Suddenly my guide put on the brakes. "There's a bunch!" he exclaimed. "See them?"

"No. Where?" All I could see was the heat devils on that desert.

"Over there. A stud with a bigger than average bunch of mares."

By this time I had unloosed the binoculars and was focusing on a patch of

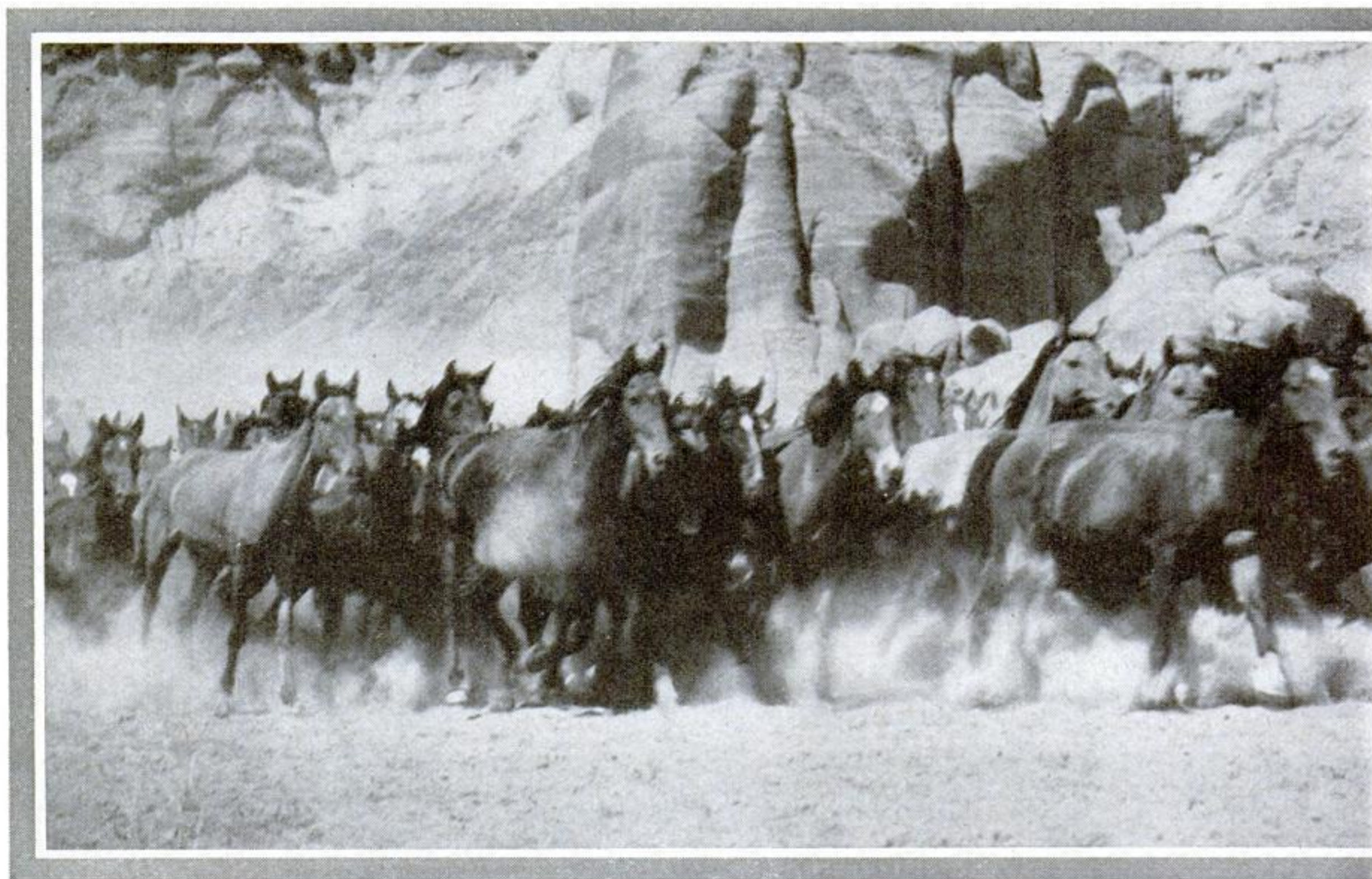
yellow desert about a mile away. Sure enough, there were the wild horses—about twenty of them. The leader was a black stallion, and he was looking at us, his ears trained forward, his tail up, the very picture of wild defiance.

"Shall we go after them?" I wanted to know. I was getting excited.

"Shucks, no! You couldn't catch those horses with anything short of an airplane in this country, and then you'd only scare them," Wright pointed out. "All you ever get out of running mustangs is leg-weary saddle horses. I don't know of anybody who ever caught a decent mustang with a saddle horse, unless he ran him away from water. That isn't so hard. But the mustang's never any good afterward."

Running away from water is an old horse-catching practice that the Indians discovered centuries ago. You lie in wait at a water hole, your horses all saddled and ready. The mustangs come in. You let them tank up, and then you dash into them pell-mell, hollering like mad. They run in all directions, and you take after them. Filled to the gills with water, they soon become winded. You dab your rope over one, choke him down, and you've got you a horse. The trouble is that a mustang run away from water is a wind-broken animal forevermore, and not worth what it costs to break him out.

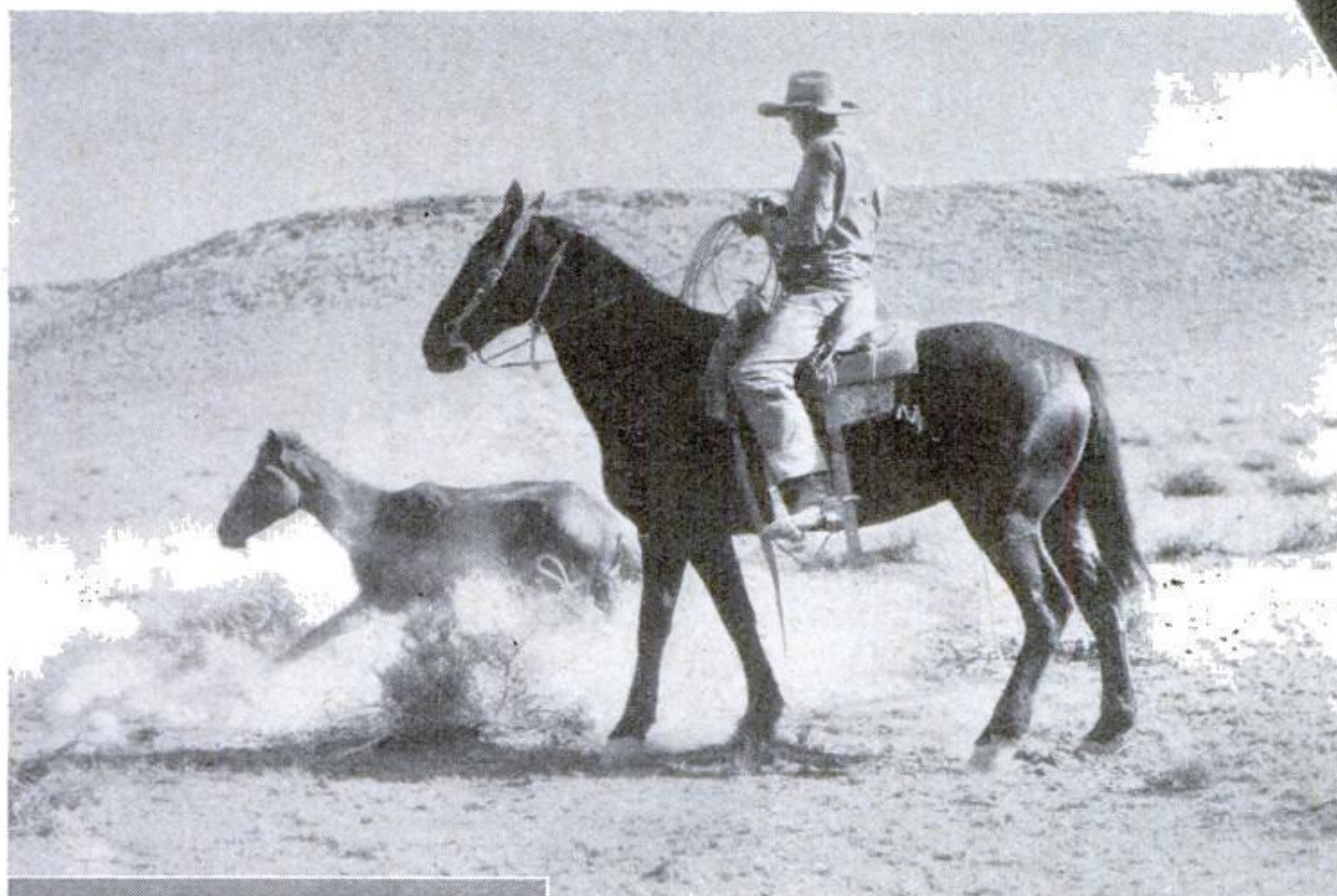
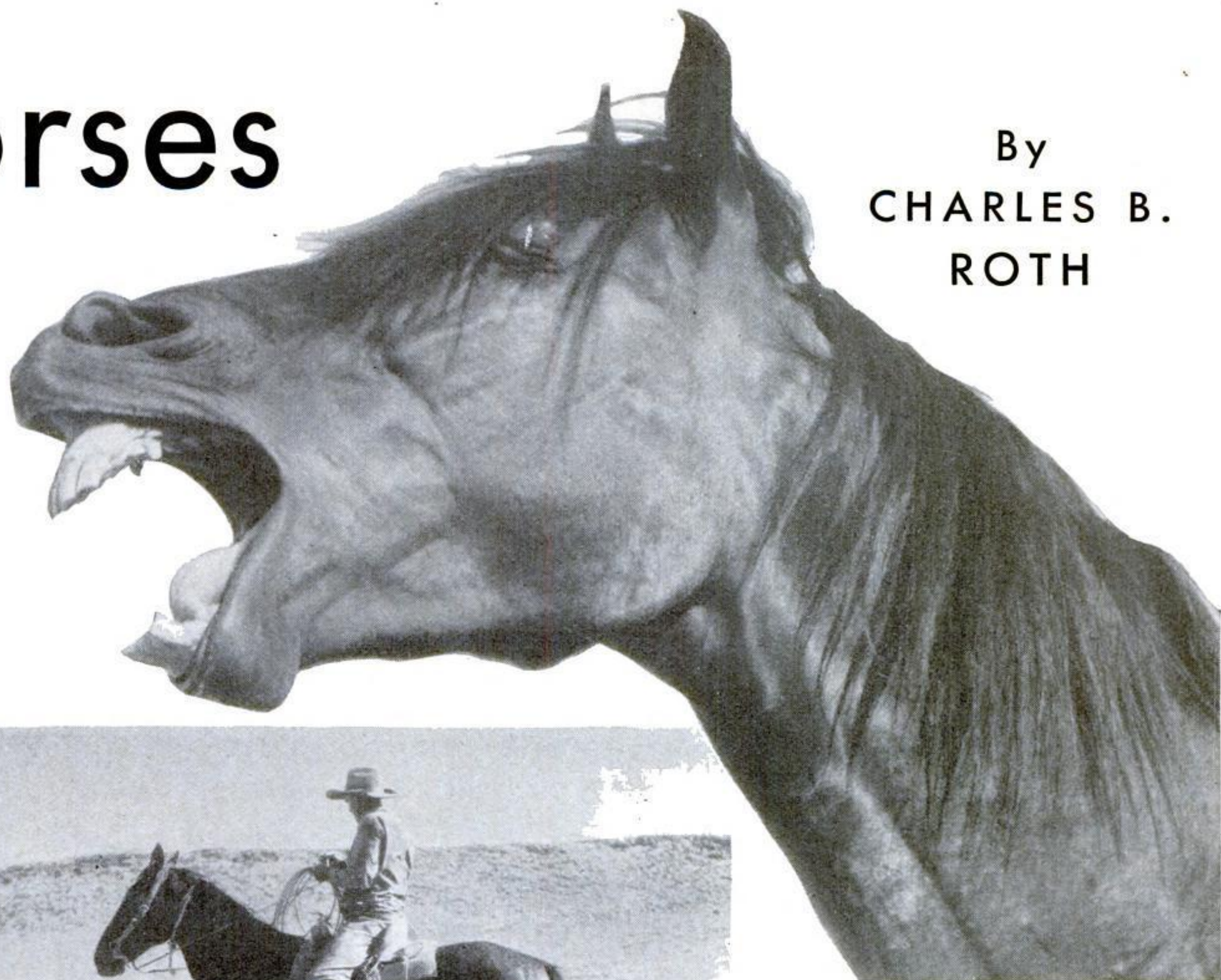
"How are we going to catch these critters?" I was curious to know. Then



A herd of captured mustangs being driven into a corral. These wild descendants of Spanish horses will be

Horses

By
CHARLES B.
ROTH



One of the hunters roping a newly caught horse. The animal will begin its education in hobbles



broken for use on cotton farms

I got the lowdown about the horse traps.

In this dry country, there are only a few places where the mustangs can get water. These are the pockets, or washes, where the run-off collects. They haven't water in them all the year around. During dry spells, the mustangs have to range farther and farther for water. They follow well-defined trails, which show you where the wild bunch is watering.

You fence the hole, making a gate at one end so that the mustangs can go in and get water. At first they avoid the trap, frightened by the human smell. But in time they brave the danger and come to drink. You let them get used to it with the fence up for maybe a week.

And then some night you wait out in a blind like the ones duck hunters use. You sit huddled up there until they get in and get settled. Then you rush down and close the gate. The walls of the wash are high and steep. The mustangs can't scramble over. They're in there—a terrified, milling, squealing band of horses. Now all you have to do is to take them out,

one at a time, into a catch corral you have fenced off at one end of the trap. Here you put a flank hobble on each one, and lead them out for three or four days of kindergarten education. Then they're no longer wild ones, but saddle horses, some of them as good as any man could want.

These things Roy Wright explained to me as we bumped and chugged along the flat Arizona Strip country. Three more bunches we saw during the next twenty miles—one of fifteen animals, one of eight, the last of three.

Then we came out onto a flat, and saw a band of a hundred or more newly caught mustangs herded by three riders. We went over to look at them. They all seemed docile enough, the whole hundred head, yet up until three days before not one horse in the bunch, except the five saddle animals allowed to run with them to help the gentling process, had ever been nearer to a man than a mile. They were rangy and thin. Some were mighty poor specimens, ewe-necked and jug-headed. But, for the most part, they looked like good western saddle stuff to me. Some were small, 600 pounds and under, but I spotted one old boy who would run close to sixteen hands and weigh a thousand just as he stood.

The first thing a mustang hunter does with newly caught horses is to put the flank hobbles on them. They rear and buck and snort and kick. But these wild-horse men are tough, too. They rope a horse around the neck and choke him into submission, then throw him down. They take a short length of rope and tie one end to a forefoot, just (Continued on page 140)

Ben Blue, a human actor, sharing the stage with the puppets in a scene from a new musical film production



Marionettes

GO HOLLYWOOD

By PHILIP BAILEY



A close-up of one of the chorus-girl marionettes. At the right is Russell Patterson, designer of the figures, putting the finishing touches on one of his odd creations



MARIONETTES in the guise of chorus girls and movie stars dance and strut before a starlit background in one of the most novel scenes ever devised and filmed in Hollywood. Cleverly carved and costumed by skilled craftsmen working under the direction of Russell Patterson, famous artist, the puppet entertainers were accompanied in their marionette musical comedy by a curious symphony orchestra made up of weird animated instruments that played themselves.

Most of the dummy performers, which are featured in the recently completed film "Artists and Models," are about three feet high, with bodies shaped from sponge rubber and hinged moving parts carefully carved from wood. Each marionette was operated by a maze of invisible strings manipulated by groups of operators working out of the camera's range on platforms built above the stage.

Some idea of the intricate and painstaking workmanship which entered into the construction of the marionettes may be gained from the fact that one figure required almost two dozen separate operating strings. These were fastened to hinged parts representing hands, feet, head, back, forearms, shoulders, and face. Even the hat perched on one puppet's head was attached to a group of strings so that he could tip it with a flourish. The orchestra maestro and the armlike appendages that played the twenty-eight animated instruments were not controlled from above,



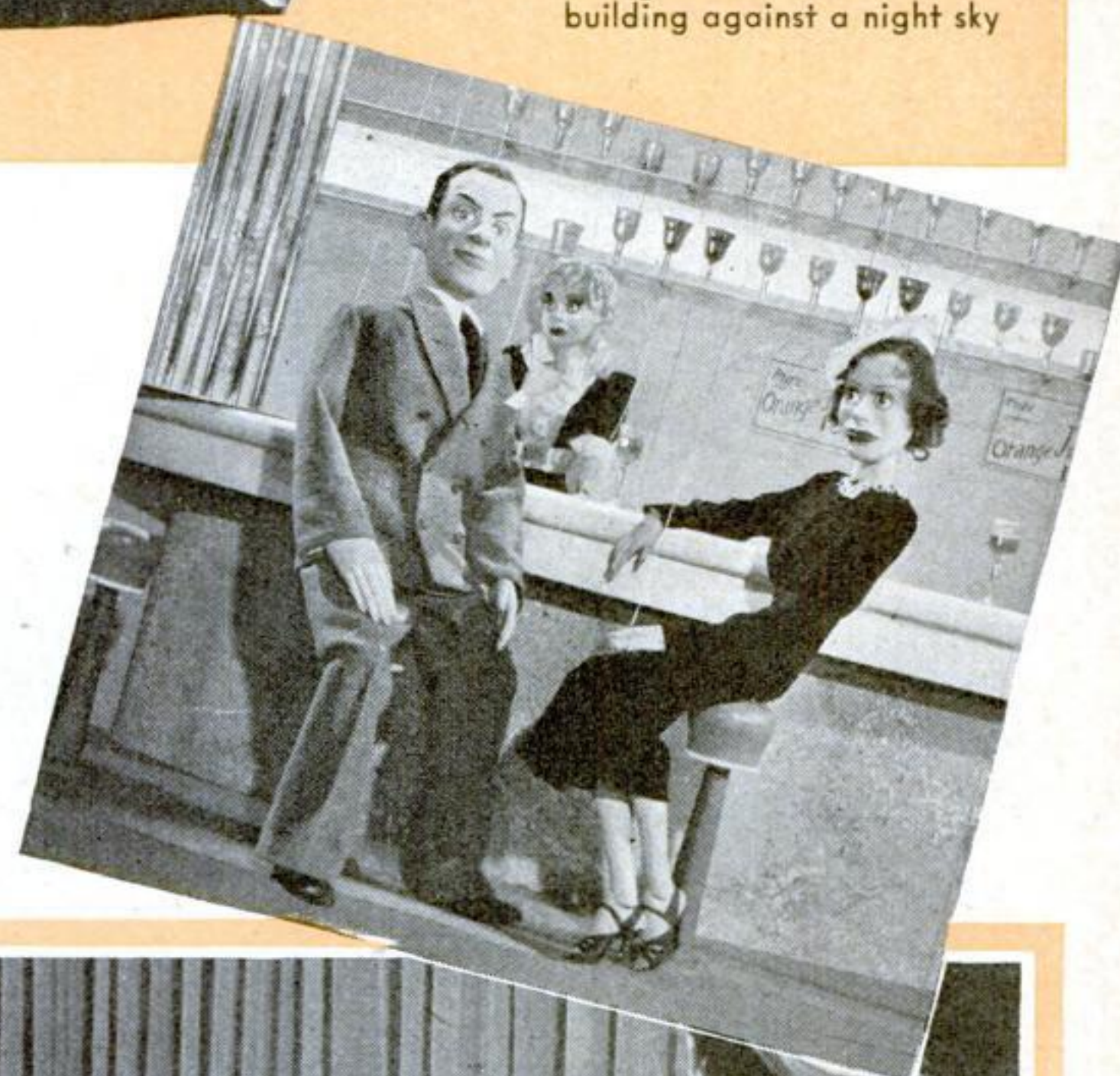
The chorus on the stage of the make-believe set. The background is a modernistic building against a night sky

This is the dummy orchestra leader. His players are musical instruments with arms worked from underneath the stage

however, but were moved realistically by wires extending down through the orchestra platform, which was built on an elevator so that it could be raised or lowered in front of the stage for the various scenes.

Startling effects were obtained by having the eyes and the mouths of some of the puppets move. As silk-haired marionette chorus girls swirled out from the wings, pranced across the stage, and went through an intricate dance routine, their long, curling eyelashes fluttered coyly in response to the movements of the invisible strings threaded through concealed holes drilled in their heads. The mouths of puppets who form a feminine musical trio for one scene were mounted on hinged sections so delicately balanced that the dummies appear to be actually pronouncing the words of the song they are supposed to be singing.

Perhaps the most remarkable feat achieved by the marionette operators was their expert handling of the puppets during the scenes in which a comedian strolls out on the diminutive set to strut like a Gulliver on a Lilliputian stage. Cleverly manipulating the hundreds of strings so that they would not become entangled with the human performer, the operators were able to manage as many as a dozen marionettes as they clustered about the comedian, aped his gestures, or climbed up on his knee.



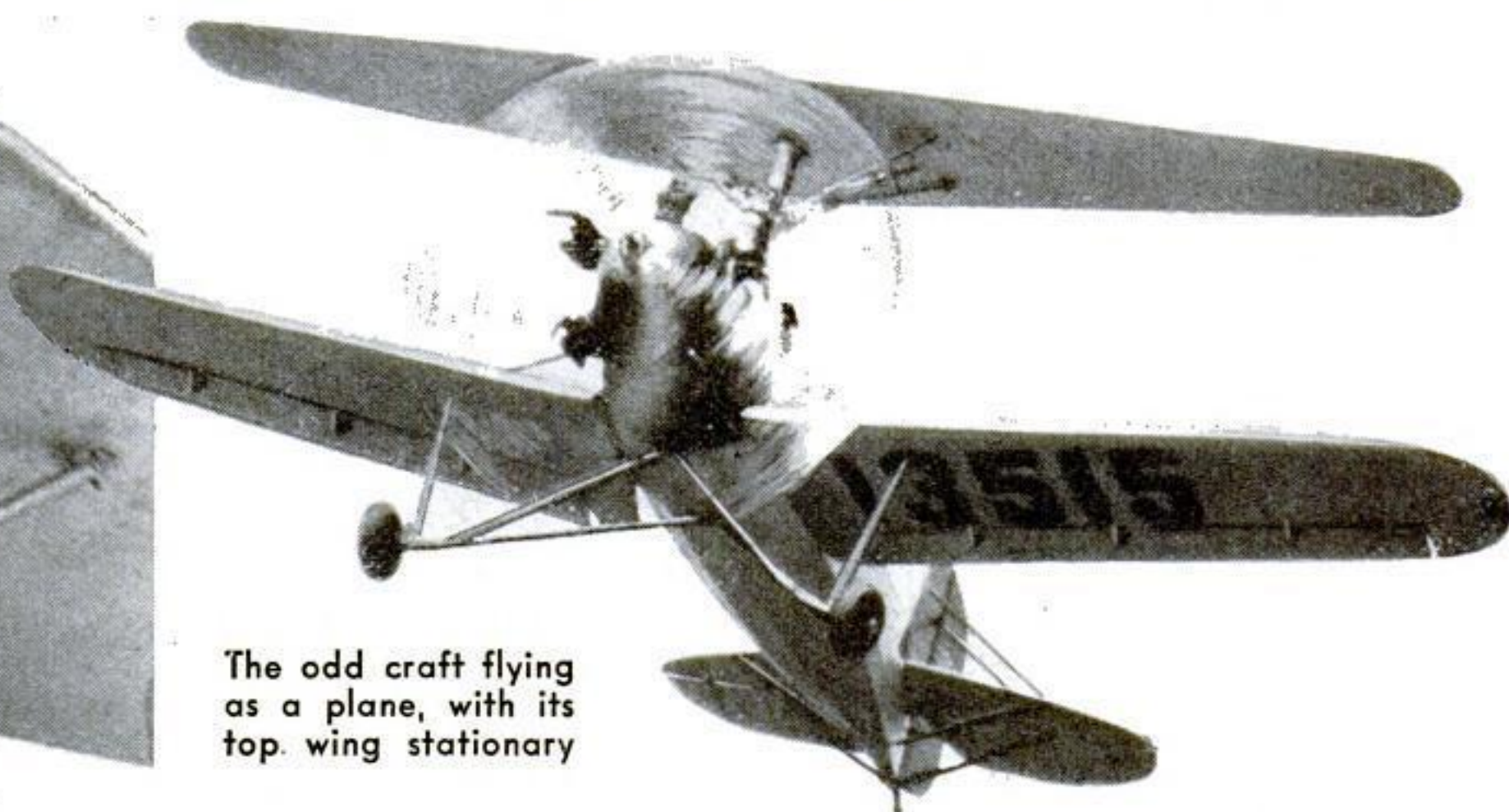
These pretty puppets go through the motions of singing, but the music is really produced by the sound system. Above them is an intimate scene between two marionettes that double for two of the real players in the main part of the photoplay



Revolving Upper Wing Makes Airplane an Autogiro



This drive mechanism rotates the wing for take-offs and landings



The odd craft flying as a plane, with its top wing stationary

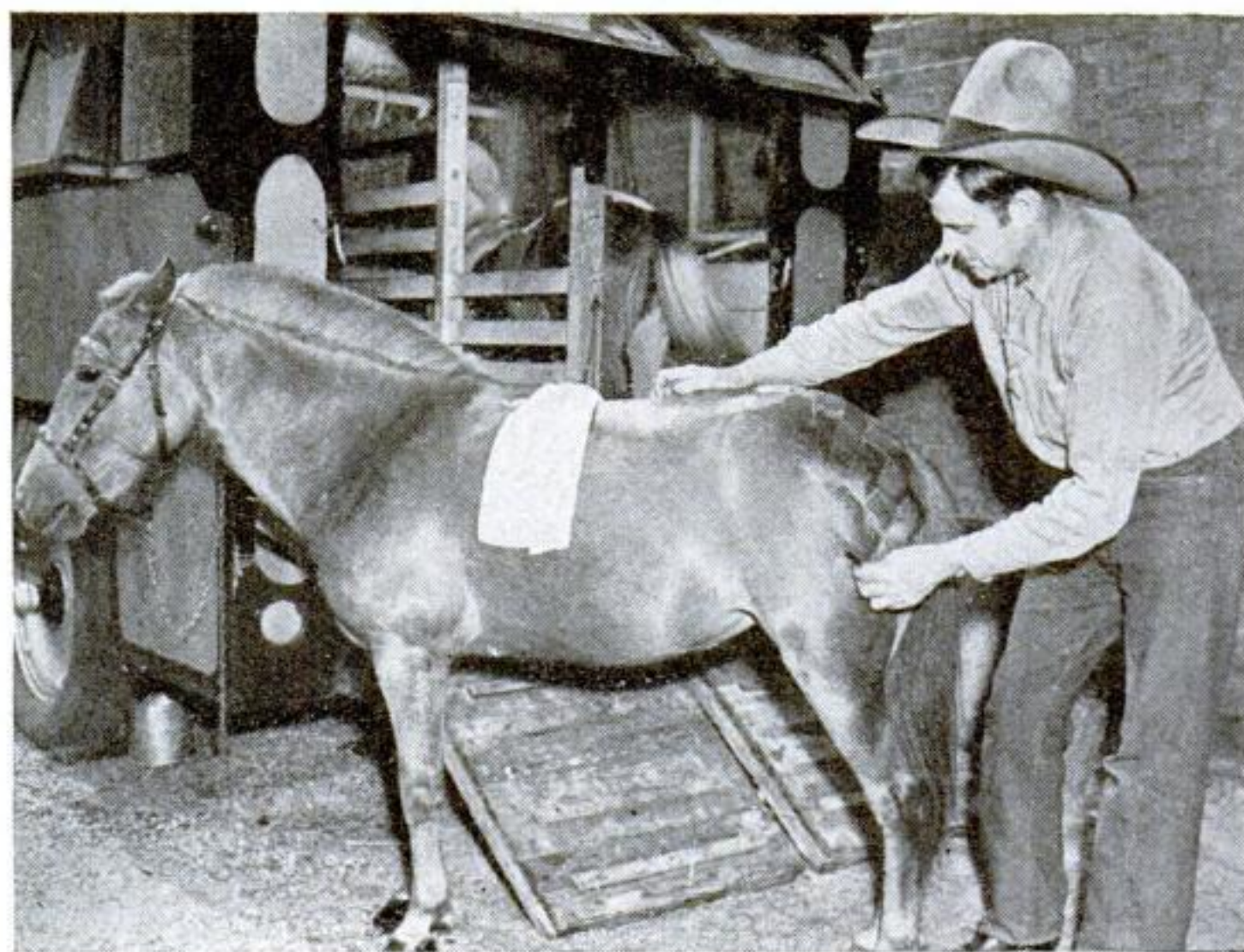
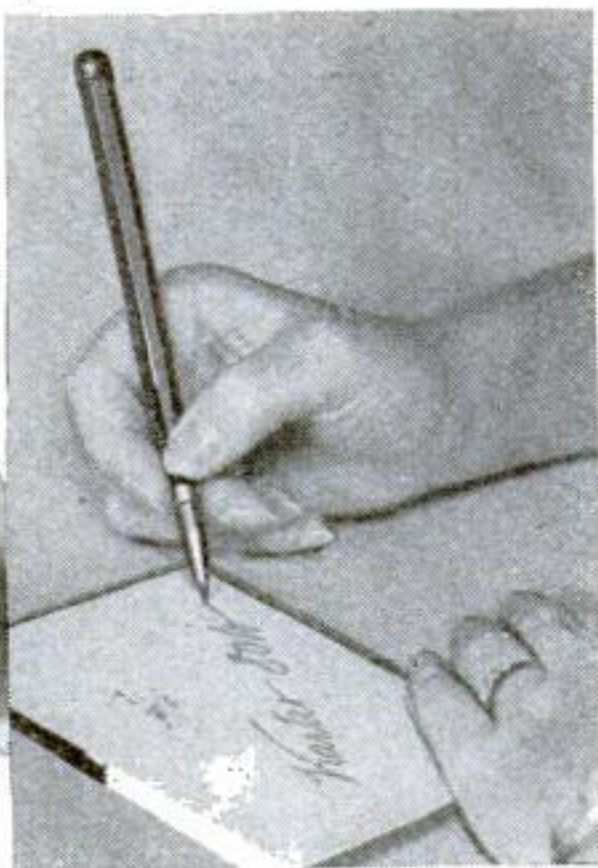
CALLED a vertaplane, a new airplane which successfully completed its first public flight recently combines many of the features of autogiros and conventional aircraft. The upper wing of the novel ship remains stationary in normal flight, but whirls like an autogiro blade to permit take-offs and landings at slow speeds and in confined areas.

Mechanical Pencil Sharpens Itself

TINY blades inside the case of a new mechanical pencil slice the lead to any degree of sharpness when a knob is pressed and turned. The knob springs back to position when released.



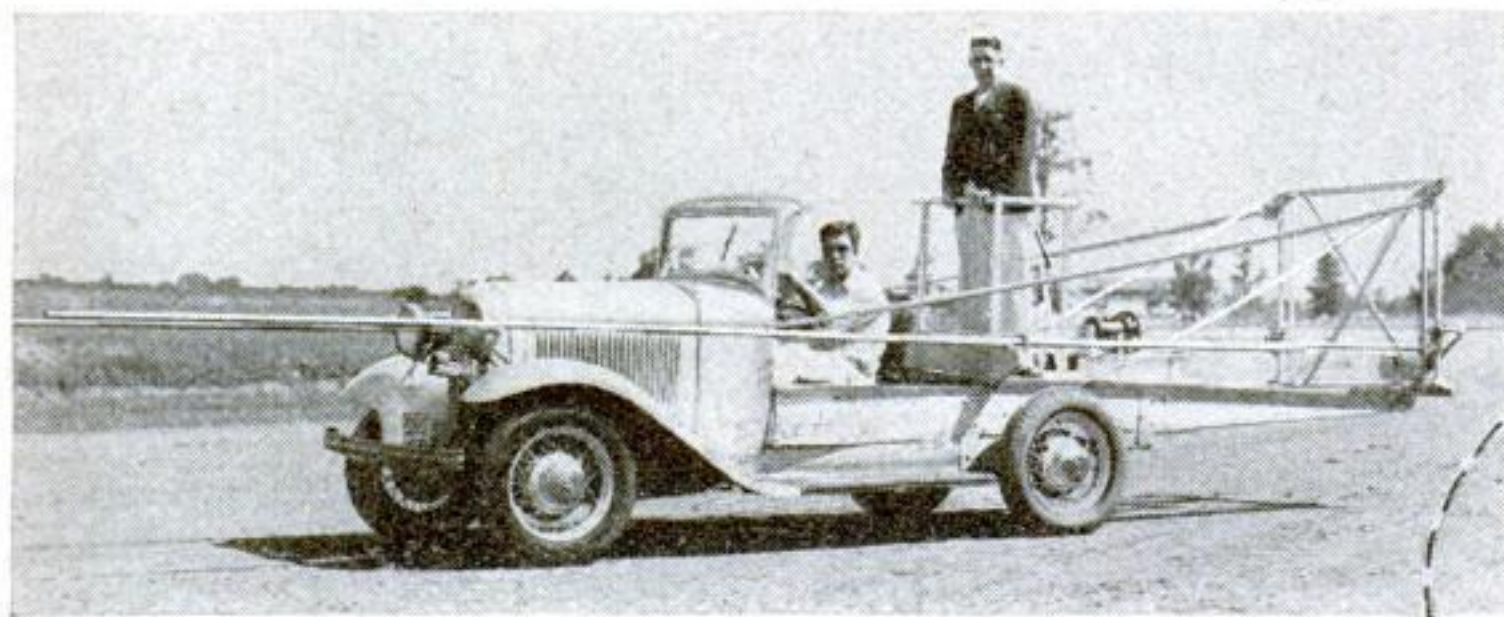
Self-sharpening pencil in use and, left, how a knob is turned to shave the point



Performing Pony Tours in Trailer

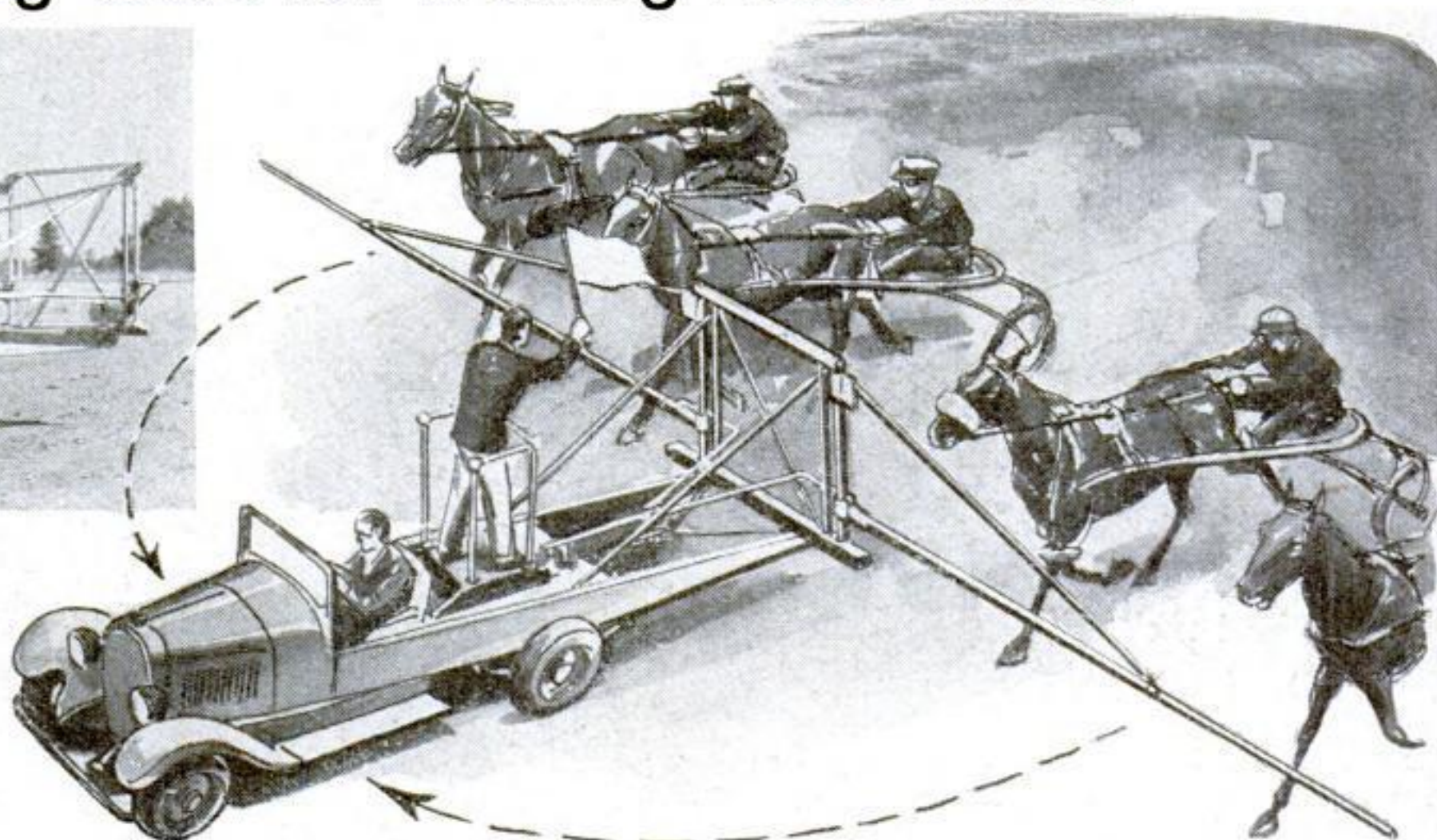
A PERFORMING pony, trained to put on a vaudeville act, tours the country in a trailer stable. The photograph shows him being groomed before a performance outside his traveling stall in a vacant lot in New York City.

Truck Carries Starting Gate for Trotting-Horse Races



The mobile barrier that helps to prevent false starts

HORIZONTAL metal arms on the rear of a special truck line up trotting horses for the start of a race. The mobile barrier precedes the trotters at a slow pace, until the starting mark is reached, when the arms fold forward and the truck speeds ahead and off the course while the horses complete the race.

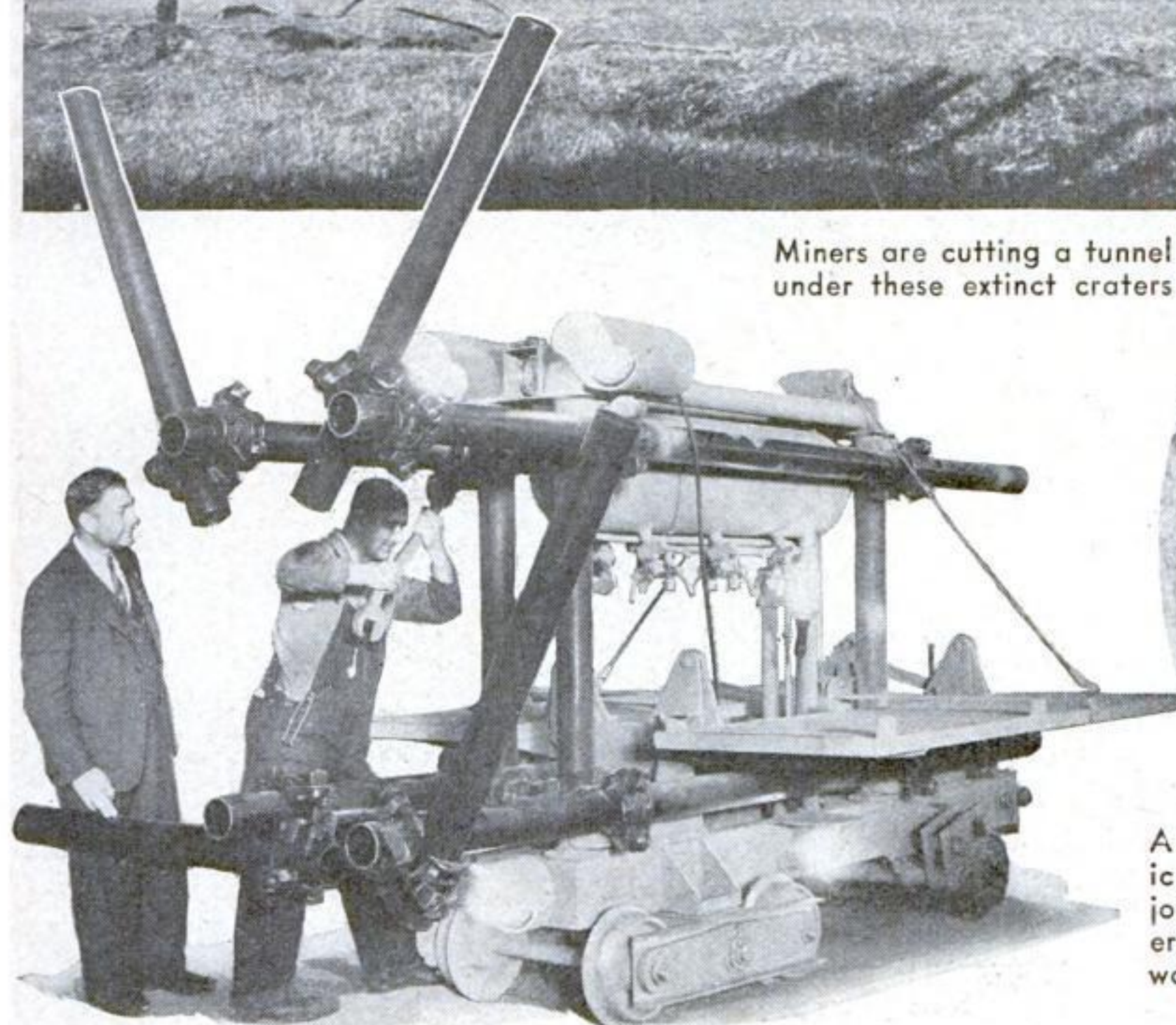


Horses follow the truck to the starting mark, when the gates fold and it speeds away

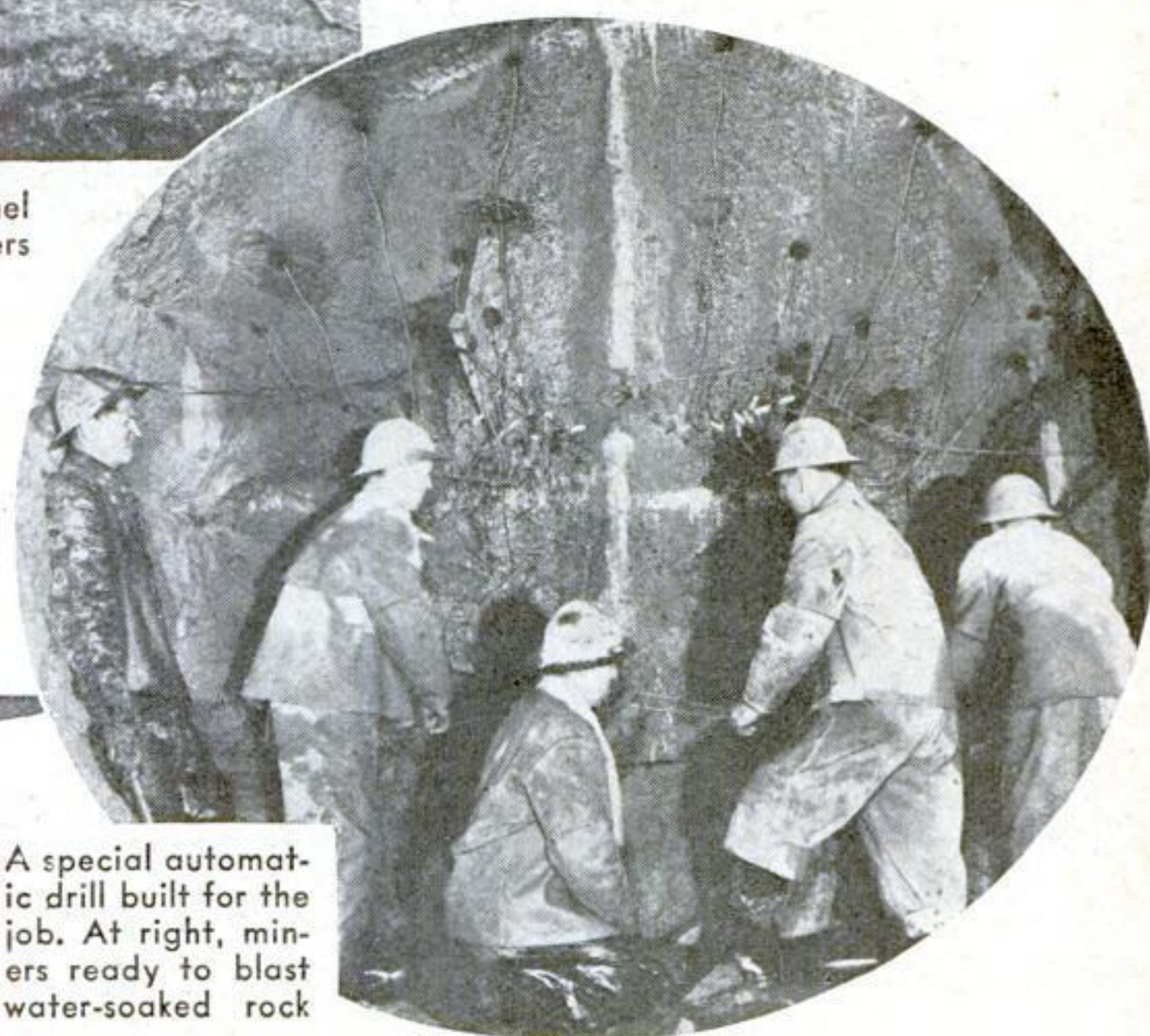
Aqueduct Tunnel Drilled Through Extinct Volcanoes



Miners are cutting a tunnel under these extinct craters



A special automatic drill built for the job. At right, miners ready to blast water-soaked rock



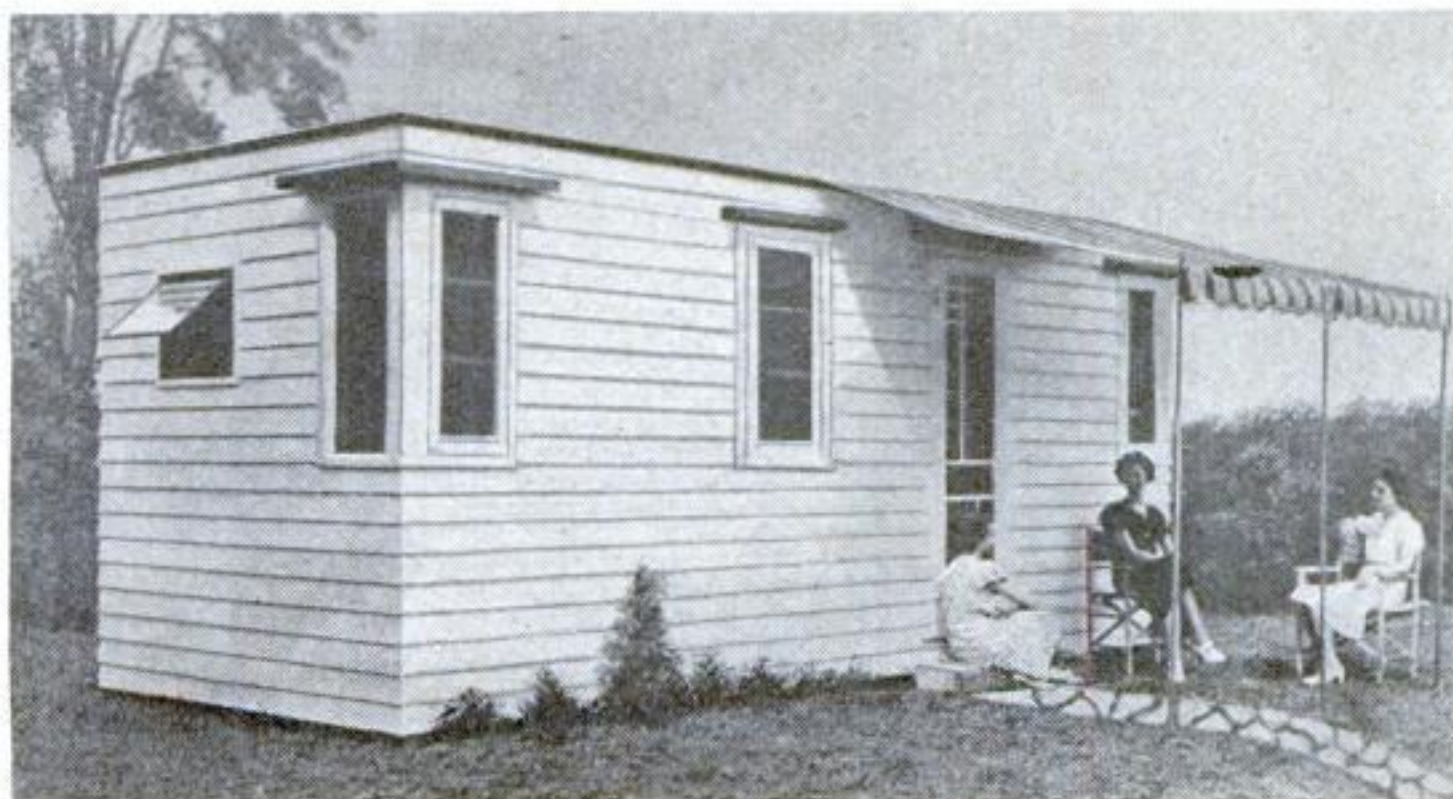
BLASTING their way through rock saturated with water that is highly charged with carbon dioxide gas, miners are now drilling an eleven-mile tunnel through extinct volcanoes near Mono Lake, Calif., as part of an aqueduct system to provide water for the city of Los Angeles. Using heavy dynamite charges, in addition to an automatic drilling machine that eats its way into the soft rock, the miners line the tunnel with concrete as they move ahead, to seal it off from the bubbling water and quicksand they encounter. The \$5,000,000 job will be completed next year.

Reflector Vest Safeguards Policeman

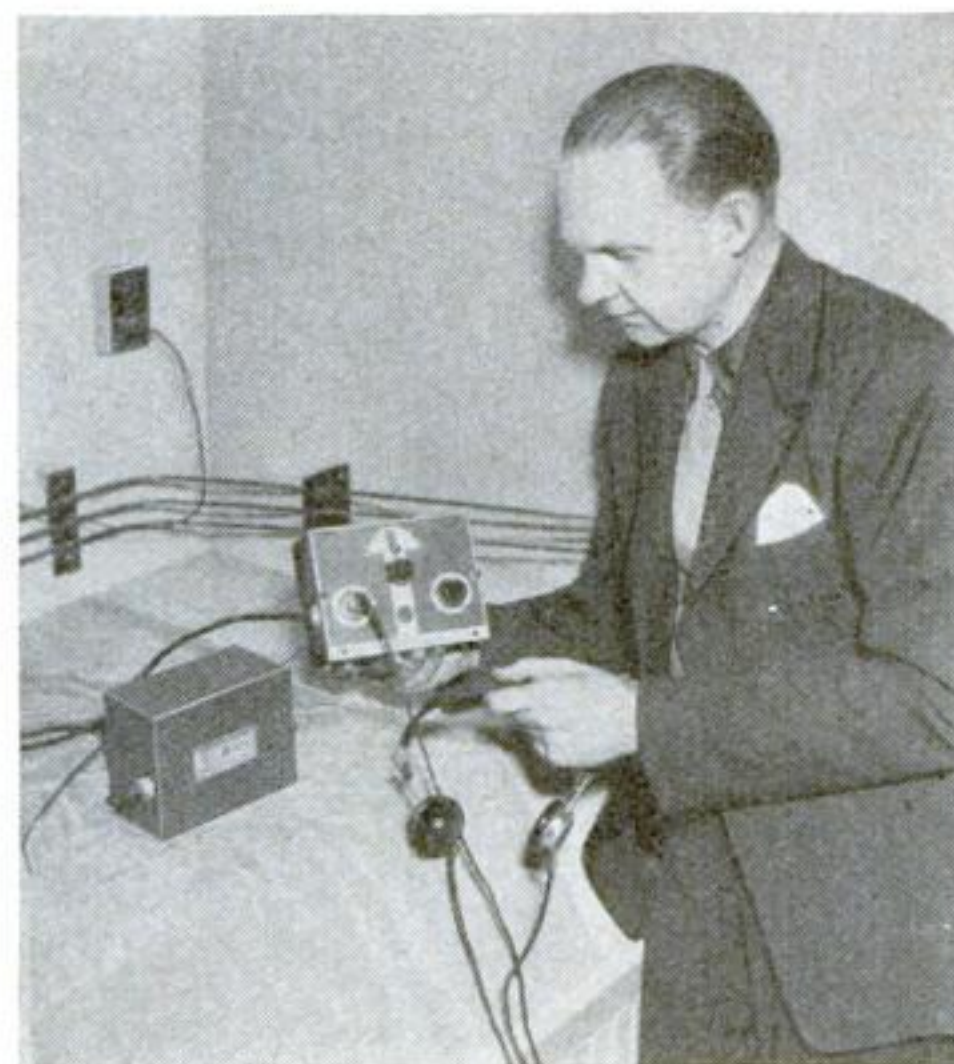
STUDED with reflector buttons on the front, back, and shoulders, a new safety vest for policemen has just been adopted in Bridgeport, Conn. Worn at night, the vest reflects the lights of approaching cars to warn motorists of a policeman's presence at unlighted corners.

Ready-Made House Costs \$500

EQUIPPED with a stove, refrigerator, window screens, dining table, couch, and other home accessories, a new type of prefabricated house costs less than \$500. Designed as a first unit to which later additions may be made, the factory-built structure includes living room, dinette, and kitchen, with folding beds for four people.



Additions can be made to this prefabricated house as they are needed



Two-Pound Radio Set Designed for Planes

REDUCED to a minimum in weight and size, a midget radio just introduced is especially designed for airplane use. The complete set, weighing less than two pounds, can be tucked into any small space, but is said to operate as efficiently as larger receivers now in general use. The photograph shows the compact unit, together with the rectifier which supplies its current.



The mammoth accordion compared with one of ordinary size



Six Persons Play Giant Accordion at Once

SIX PERSONS can play simultaneously on a gigantic accordion recently exhibited in Germany. Over six feet high, the mammoth musical instrument has

a keyboard covering more than ten octaves. Casters at the base facilitate the manipulation of the bellows.

Strange Oriental Church Is Built by Pastor

TOPPED by seven spiral domes of oriental type, a striking Russian Orthodox church under construction in Seattle, Wash., is being erected by its pastor, Rev. M. Danilchik. Aided by members of his congregation, the clergyman works seven days a week on the wooden edifice, which presents an unusual appearance because of its exotic design.



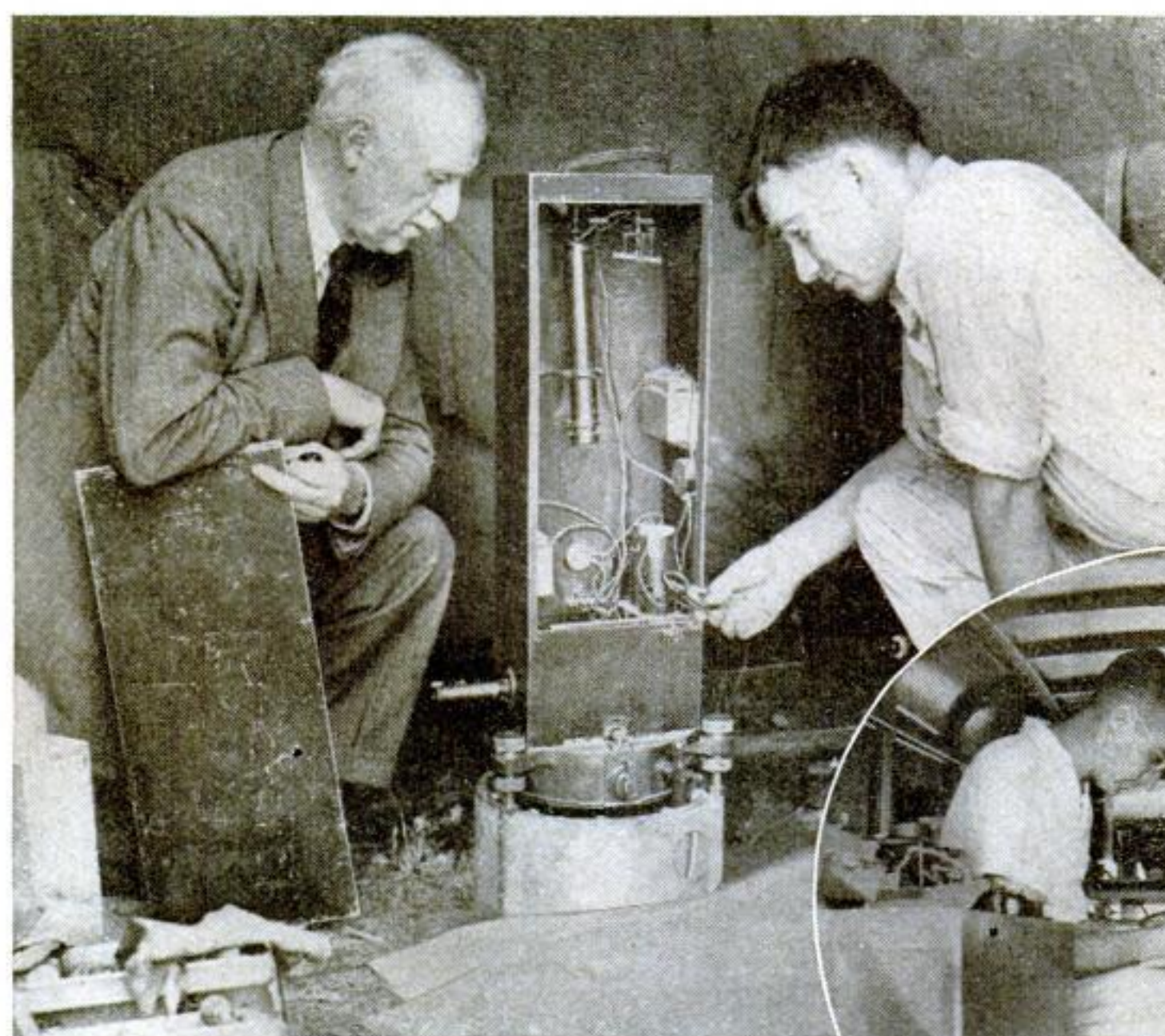
Church of oriental design being built in Seattle, Wash.

Mountain Is Weighed in Mobile Laboratory

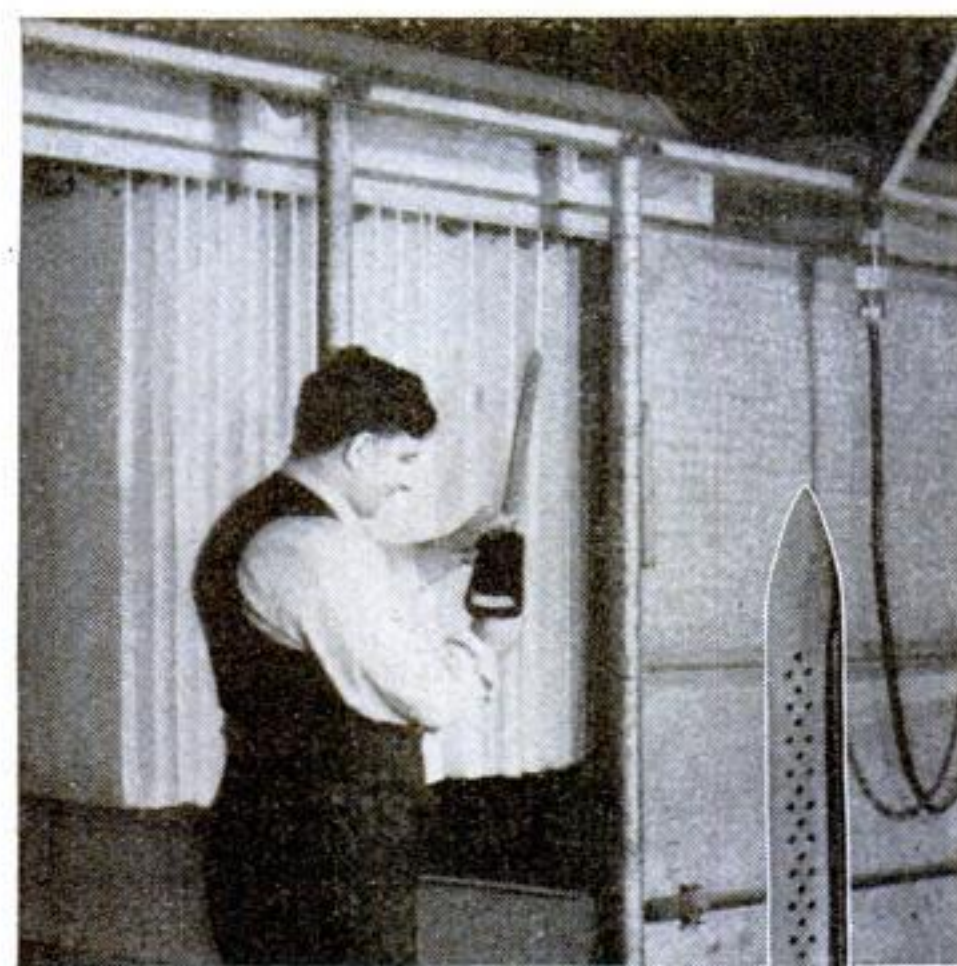
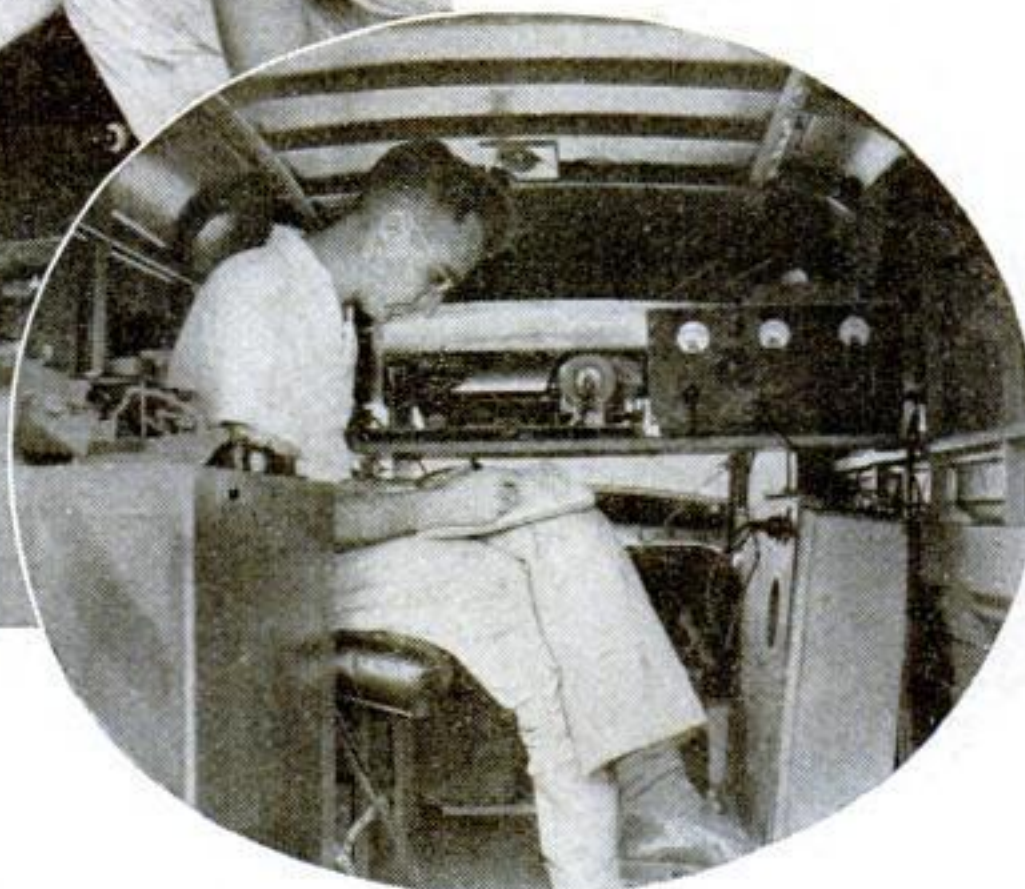
HOW MUCH does one of the heaviest rock formations in the United States weigh? To determine this and other facts about Iron Mine Hill near Cumberland, R. I., Prof. Charles W. Brown of Brown University, and Charles A.

Schoene, geophysicist of the United States Coast and Geodetic Survey are making extensive gravity tests of the unusually heavy rock formations found there. Part of the testing equipment, housed in the body of a truck, includes

a radio for receiving Naval Observatory time signals, which, when compared with the beat of two pendulums, provides the experimenters with basic data for computing the force of gravity at the site where the tests are being made.



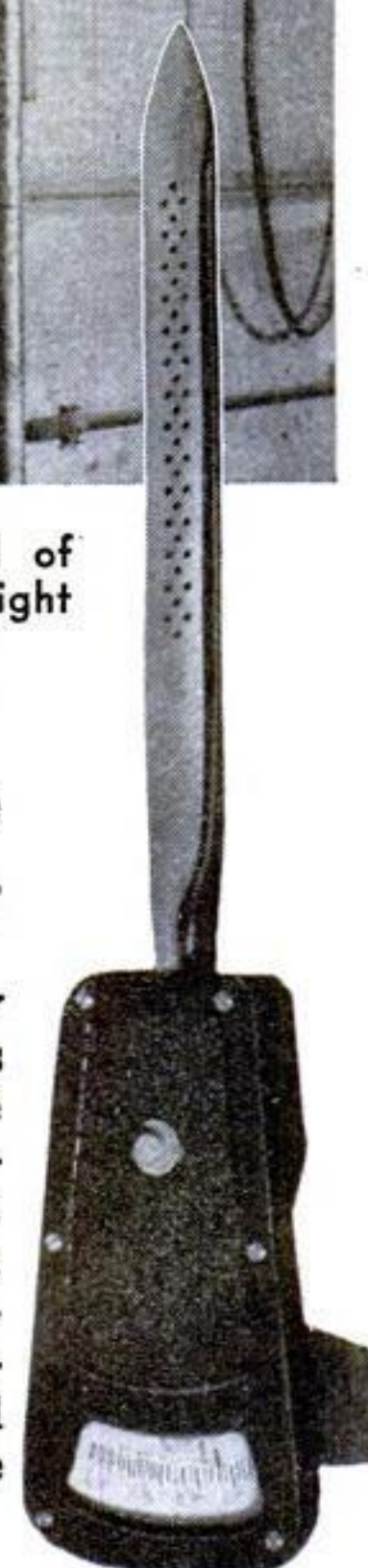
Experts checking an instrument used in measuring the gravitational pull of a mass of heavy rock. At right, time recordings being made to aid in the tests



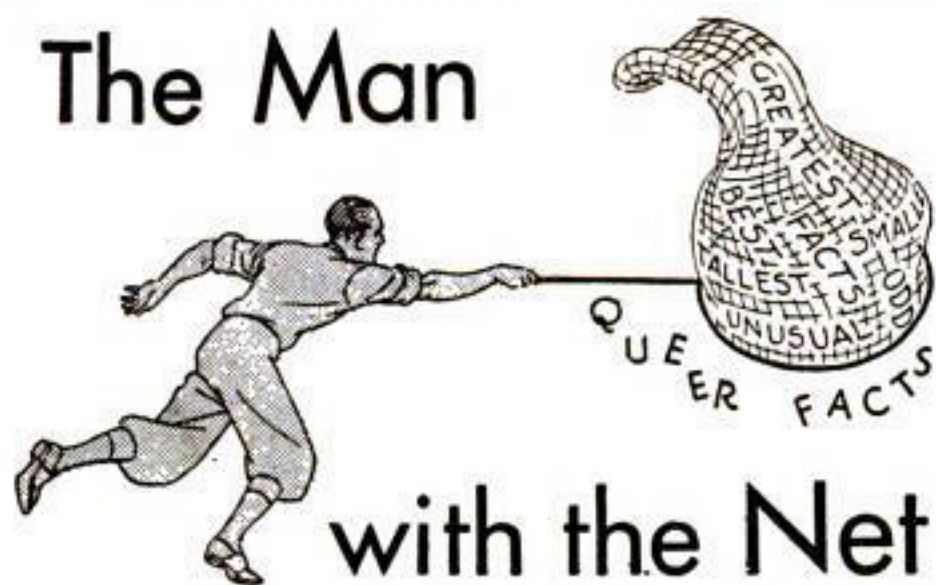
A printer reading the dial of the moisture meter seen at right

Swordlike Meter Gauges Moisture in Stacked Paper

SWORD-SHAPED, a new instrument for printers measures the moisture content of paper. A perforated blade, inserted between sheets in a stack of paper, contains a sensitive element that actuates an indicator dial in the handle end of the apparatus.



The Man



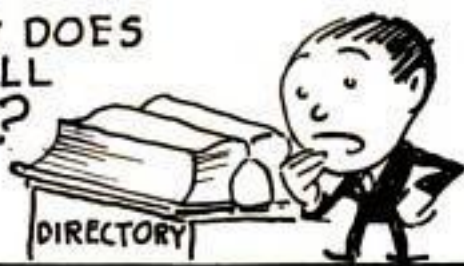
with the Net

PHOTOFLASH bulbs were suggested in 1893.

A PEAR TREE at Saratoga Springs, N.Y., turned over a new leaf and started growing cherries.

THE NAME Snyder has twenty-nine variations, all spelled differently.

NOW HOW DOES
BILL SPELL
HIS NAME?



PIPES and other plumbing fixtures are being made from synthetic plastics in Russia.

GRAY FOXES can climb trees.

CATTLE grazing on a range get only about a fourth of the grass consumed, the rest being taken by leafhoppers, grasshoppers, rodents, rabbits, and other wild life.



DON'T F'GET THEM
@*!?!-@-
SHEEP!

COLORED perspiration—red, green, yellow, black, or blue—accompanies certain abnormal conditions of the body. Sometimes, sweat is phosphorescent and glows in the dark.

ANESTHETICS for surgery and antiseptic salves for healing wounds were employed in China 2,000 years ago.

AIN'T THERE
NOTHING NEW?



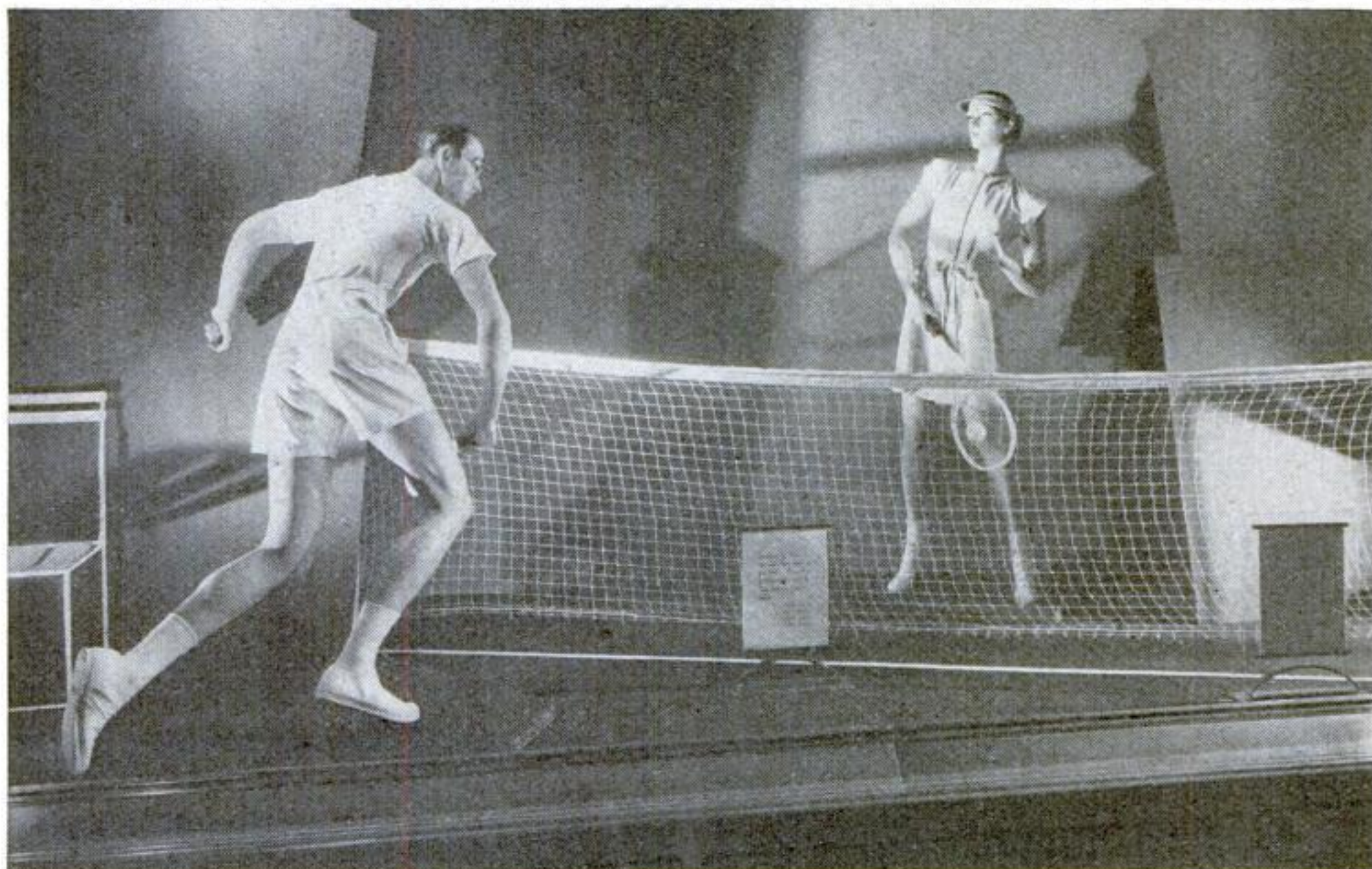
ELECTRICITY in the blood cells of a fully grown man would light a twenty-five-watt lamp for five minutes.

A GOLD WATCH lost for twenty-five years was plowed up recently by a New York farmer.

PAVED ROADS were first built by the ancient Egyptians.



Window Dummies Made in Lifelike Poses



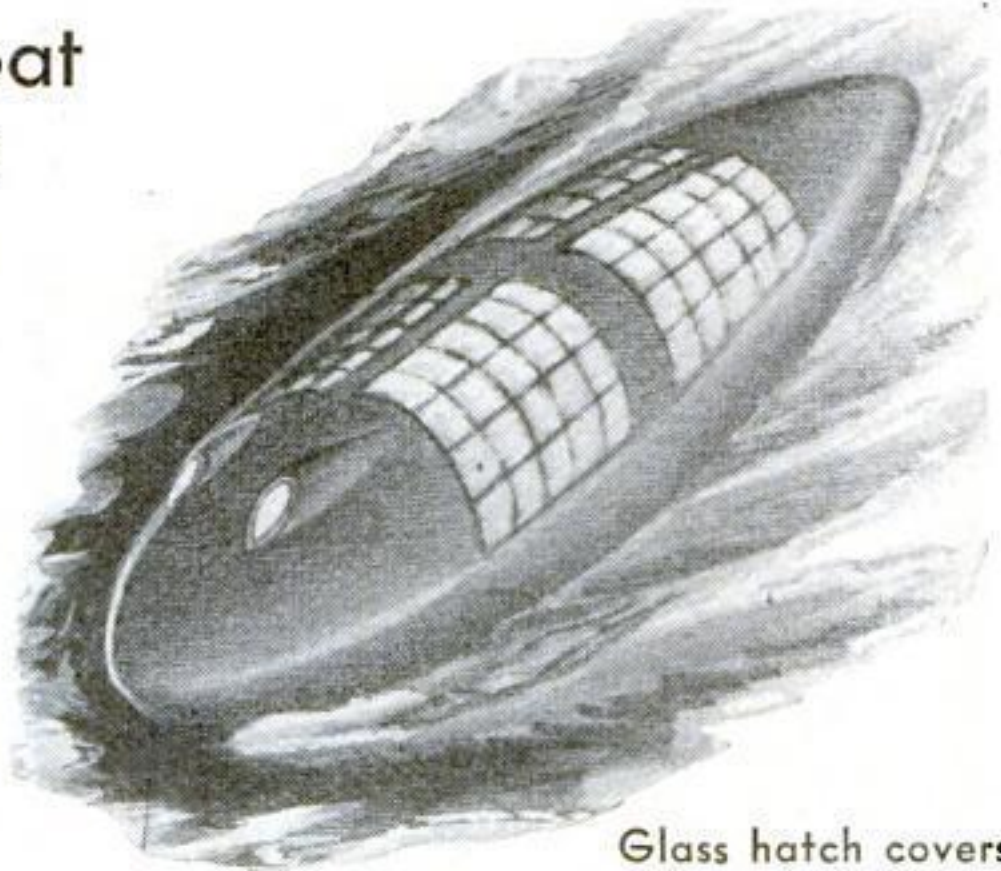
Lifelike action poses, like those above, can be obtained with these new-type display dummies

ANIMATED poses are achieved by a new type of model designed for store window displays. First sculptured in clay and then cast in plaster, the models present an exceptionally life-

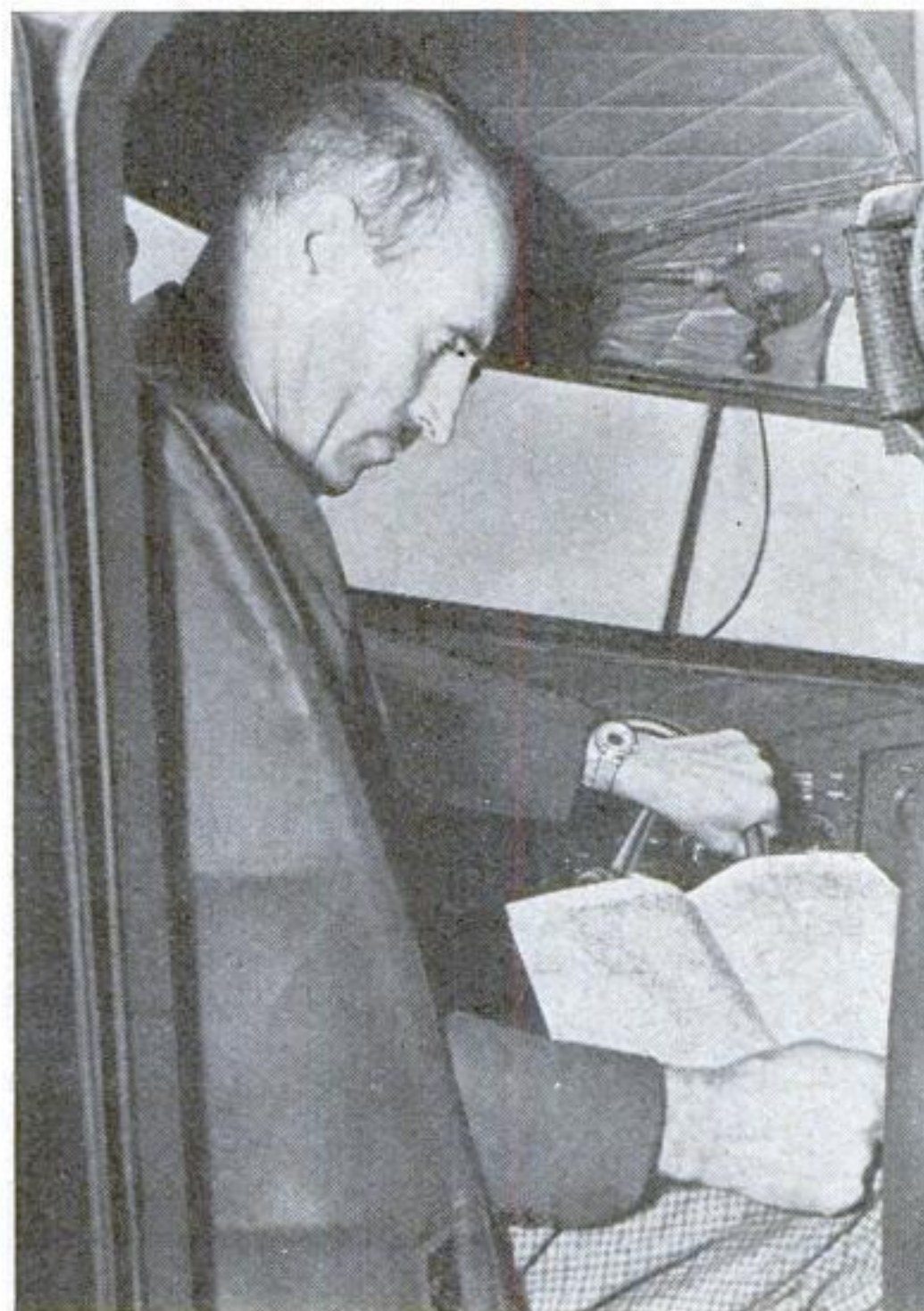
like appearance, as indicated by the photograph above. The arms of the figures are adjustable so that various effects can be obtained. Special fasteners anchor the dummies to the floor.

Novel Unsinkable Lifeboat Is Built Like Submarine

MADE of steel, an odd, streamline lifeboat just invented is declared to be unsinkable. Powered by either a gasoline, Diesel, or electric motor, the craft is steered on the surface by a conventional rudder, but utilizes movable fins to guide it up to the surface in case it is sucked under with a sinking vessel. The boat is roofed with shatterproof-glass hatch covers, which can be opened in clear weather. Safety belts and oxygen tanks for emergency use also are included in the equipment of the novel rescue device.



Glass hatch covers form a waterproof roof for the boat



Casey Jones, famous pilot, using the timepiece



This new watch replaces three clocks

New Wrist Watch Aids Aerial Navigation

DESIGNED by Col. Charles A. Lindbergh, a compact wrist watch for airplane-navigation use has a second hand which can be set accurately by radio time signals, thus eliminating the need for checking it with a chronometer. Secondary dials on the face of the watch and on the rim enable navigators to determine both Greenwich and local time. The instrument is rapidly becoming standard equipment for long-distance pilots.

Beating ROBIN HOOD

... MODERN ARCHERS SHOW AMAZING SKILL

CARRYING ON a sport whose origins are lost in the shadows of prehistoric ages, modern archers are stringing their bows to set new records that rival and even surpass the legendary prowess of Diana the Huntress or of Robin Hood and his merry men. Toting bows and arrows that in all essential details are exactly like those in use hundreds of years before the invention of firearms, bowmen from all over the world converged on Lancaster, Pa., recently for the fifty-seventh annual tournament of the National Archery Association. Men and women of all ages twanged thousands of bowstrings to vie for national honors in a sport that has been steadily growing in popularity every year. Living right with the contestants for the five days of the competition, our photographer has preserved on film some of the high lights of the novel events. The results of his efforts, reproduced on these pages, show the equipment used and depict many of the interesting angles and activities of a modern archery tournament.

SOME PULL! Charles Diehr, of New Rochelle, N. Y., shot through the whole tournament with a bow of eighty pounds drawing weight. The average is about forty

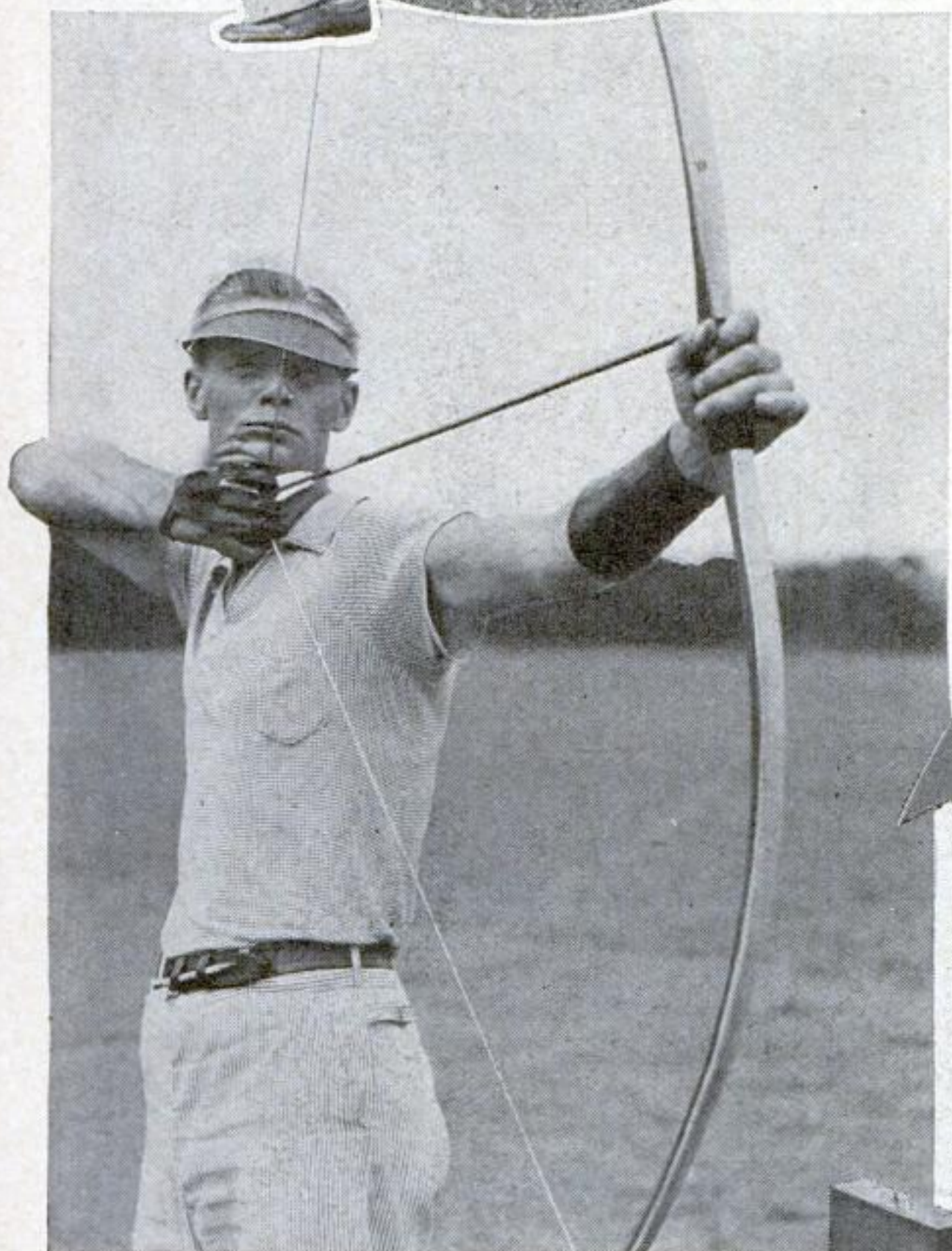
LONG RANGE. The "clout shoot" calls for a distance of 180 yards, with a giant target marked on the ground. Here the contestants are retrieving their own arrows



SCORING is done by the archers themselves. In just walking to and from the targets throughout an official competition, a bowman will cover at least nine miles—to say nothing of hunting the shafts that miss the stand altogether!

WOMEN are enthusiastic followers of the sport. In events that are adapted to their physical strength, they compare favorably with the men, although they would not be able to go through the grueling long-range contests with heavy bows. The Dianas at the right are taking part in a distance shoot

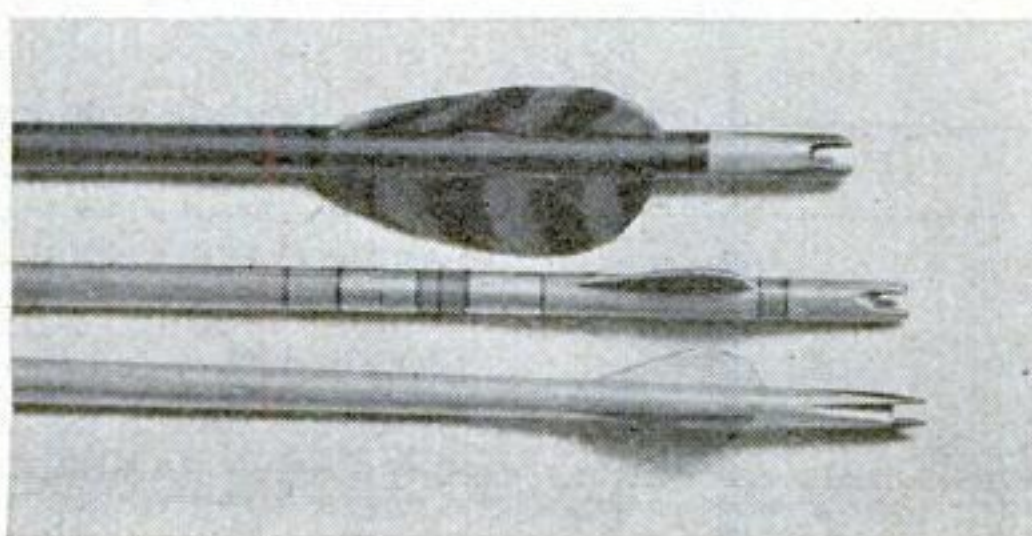
DOUBLE BEND. While few archers can handle a bow at all in the trick position shown below, National Champion Russ Hoogerhyde, of Clarendon Hills, Ill., can hit the target consistently this way at short ranges



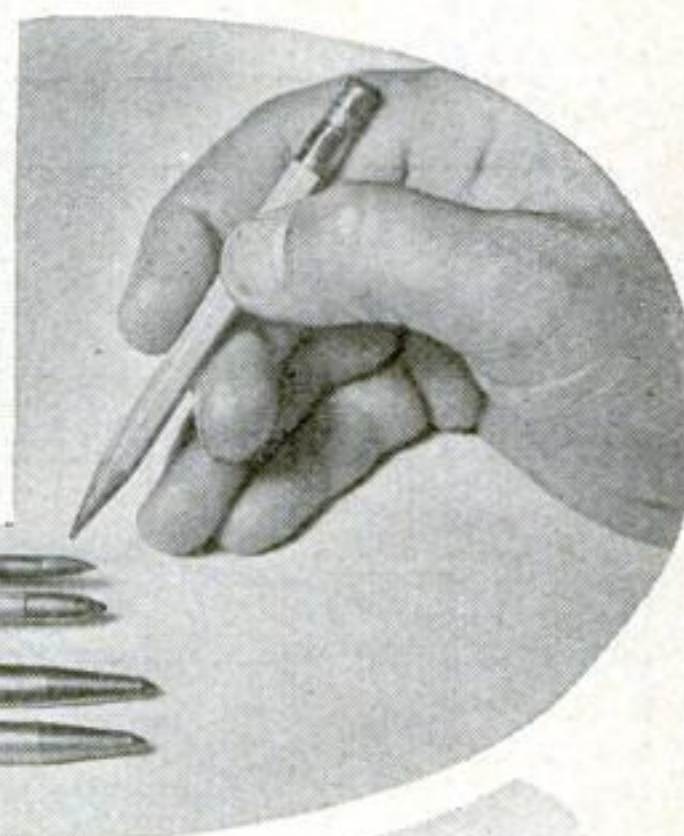
GOOD FORM. The champion shows how he aims a shaft. Note how the string crosses the middle of nose and chin

PHOTOGRAPHS BY
ALFRED P. LANE

OCTOBER, 1937



Arrow nocks and points are carefully designed for the various kinds of shooting. At the right, note the tiny tip of the new streamline flight, or distance, arrow

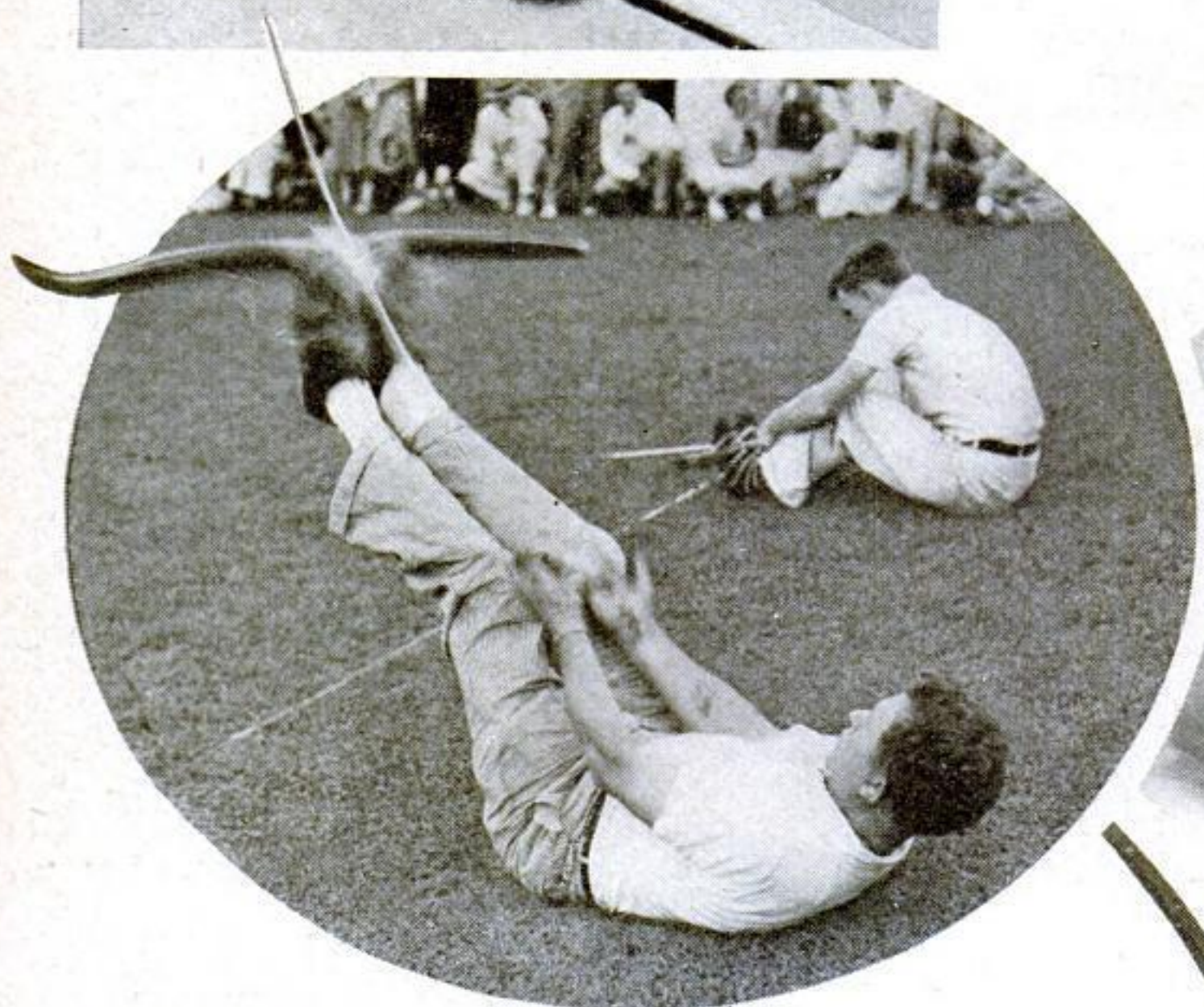


IMPEDIMENTA Trick arrow cases and spare bows are very much in evidence at the shooting line. Much of the equipment is home-made, especially the flight bows shown on the following page

TOPSY-TURVY. For free-style flight shooting, the bow is attached to the feet with straps. The contestant lies on his back and uses both hands to bend the bow, which requires great strength



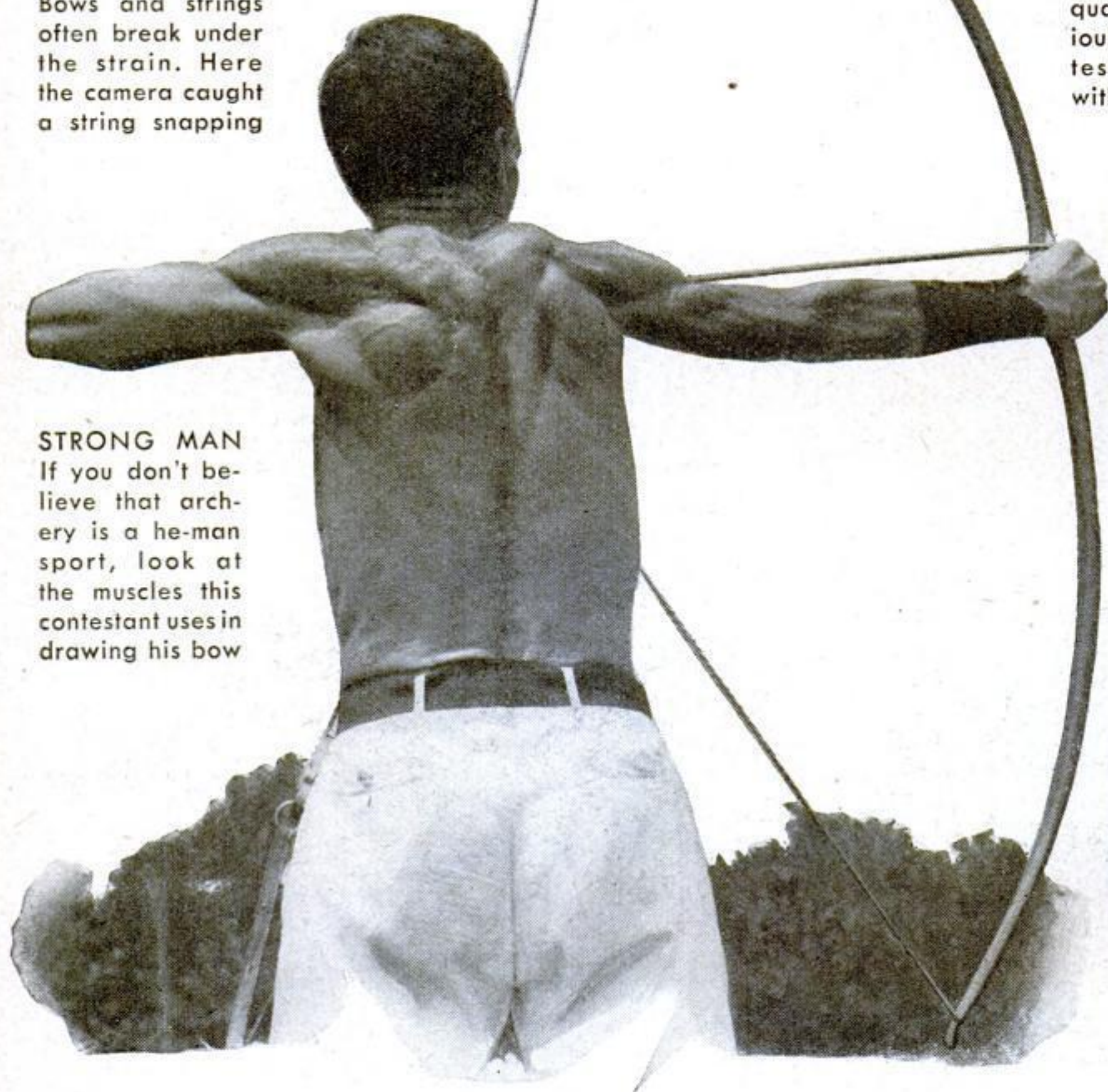
A JUMP at the instant the arrow is released sometimes adds as much as twenty yards to the flight in a distance-shooting event



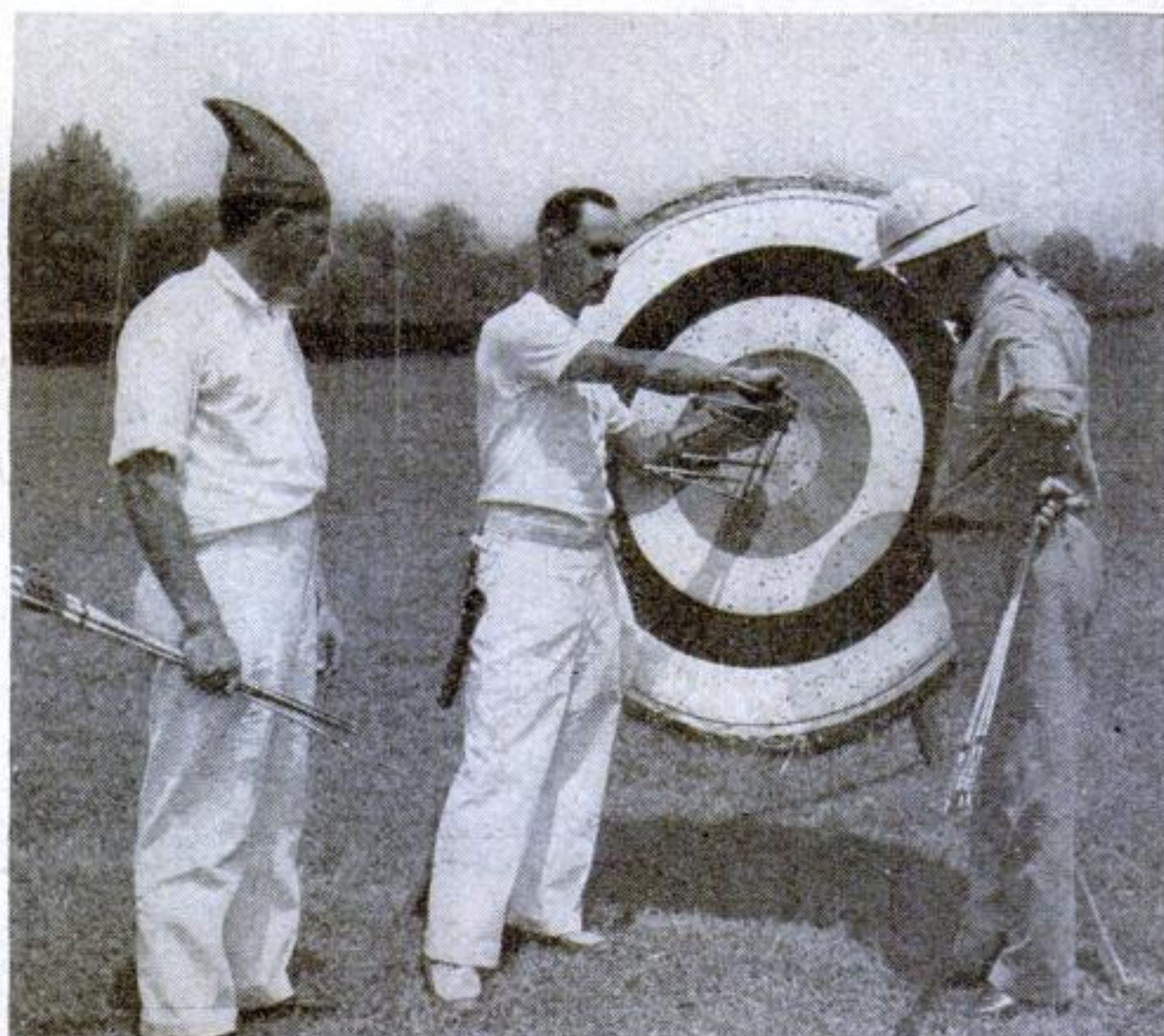
ACCIDENT
Bows and strings often break under the strain. Here the camera caught a string snapping



WEIGHING IN. To qualify for the various events, bows are tested for strength with this odd device



STRONG MAN
If you don't believe that archery is a he-man sport, look at the muscles this contestant uses in drawing his bow



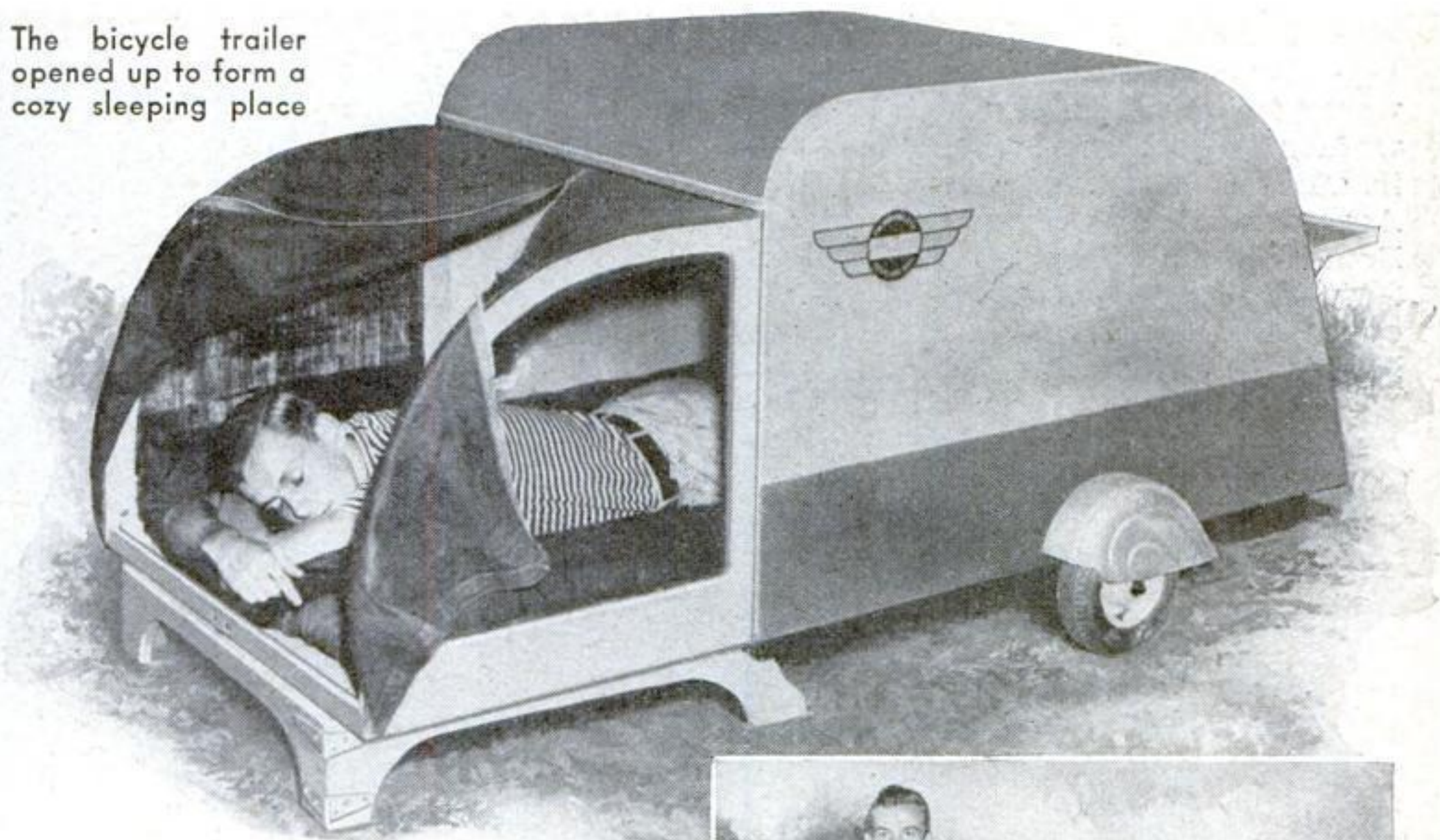
BIG EVENT. Arrows are shot in groups of six called "ends." When all six hit the gold center of the target, a whistle blows and everybody gathers to admire the feat



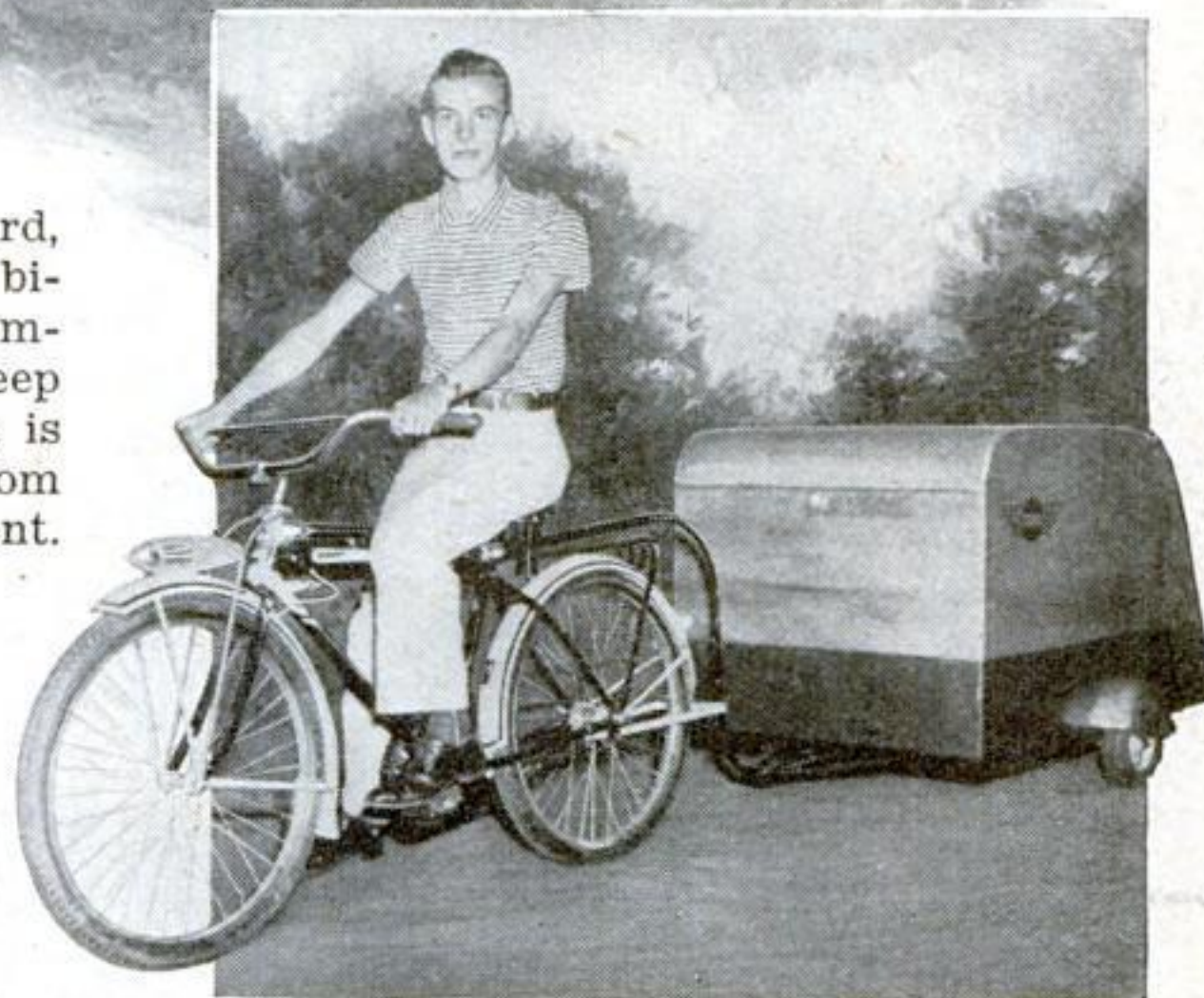
Dustless Mop Cleaner Made by Housewife

TO END the unsanitary practice of shaking mops from open windows, a housewife invented the ingenious household aid illustrated above. When the mop is placed in the can and revolved, loose wooden cubes dislodge the dirt, which falls through a screen to the bottom of the can for easy disposal.

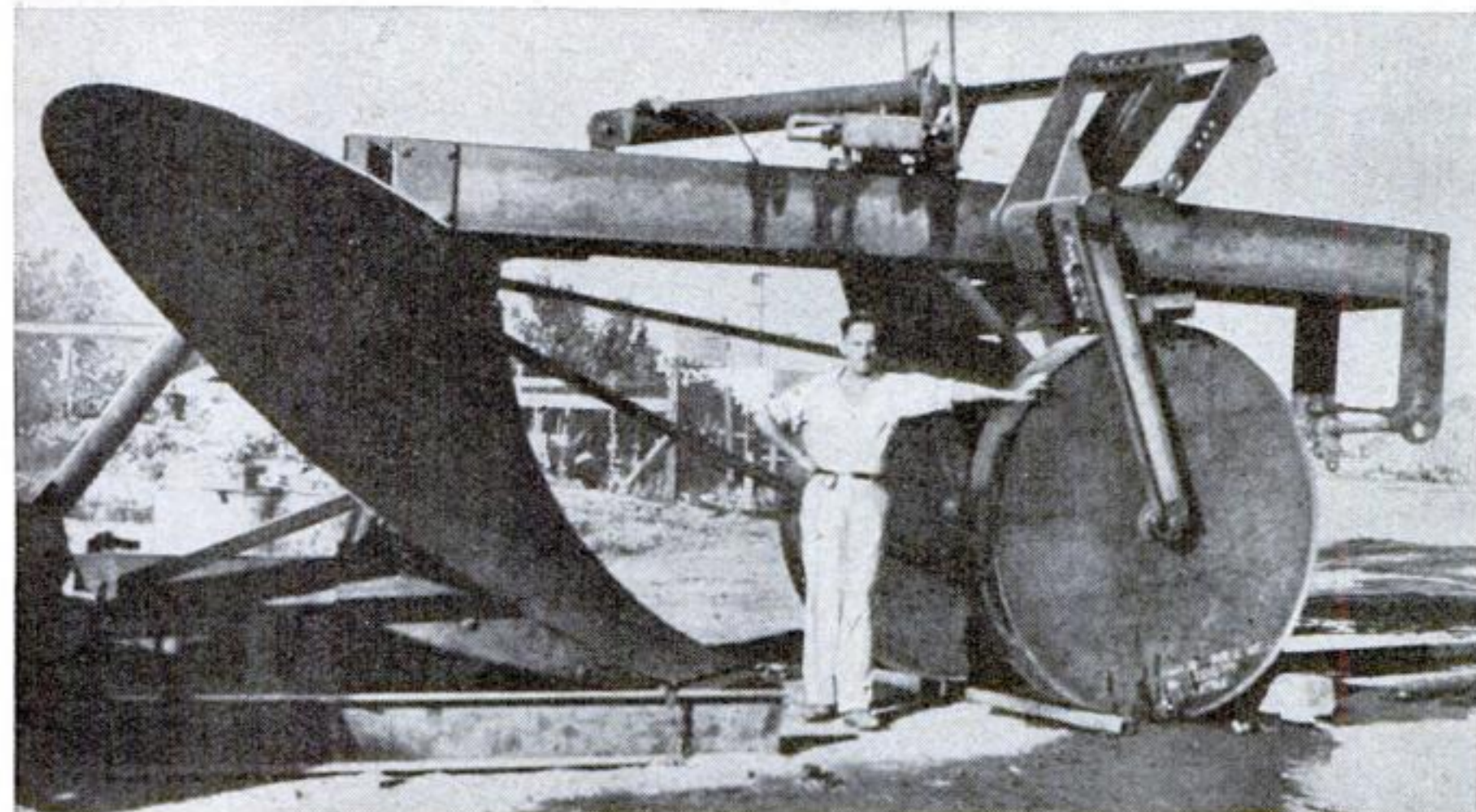
The bicycle trailer opened up to form a cozy sleeping place



ALMOST as light as cardboard, a new plywood trailer for bicycle campers opens up into a comfortable bed. Canvas curtains keep out rain, and a mosquito screen is provided for the open end. Room is provided for cooking equipment.



Made of plywood, the unit is as light as a cardboard box



Giant Plow Turns Ten-foot Furrow

WHAT is thought to be the largest plow ever constructed has recently been completed in California. Taller than a man, the monster plowshare is to be used to reclaim

rich soil buried under a deep layer of sand since a flood in 1916. Two ninety-five-horsepower tractors will pull the giant excavator. A hydraulic hoist raises and lowers the share.

Shower Holds Bath Salts

LUXURY-LOVING bathers may now enjoy their bath salts even when they take a shower. A new fitting mounted just above the spray head serves as a receptacle for the crystals and allows them to dissolve slowly in the water as it passes through the unit.



Shower head with receptacle that feeds salts into water



This cedar log is forty-one inches in diameter. At right, sounding for trees

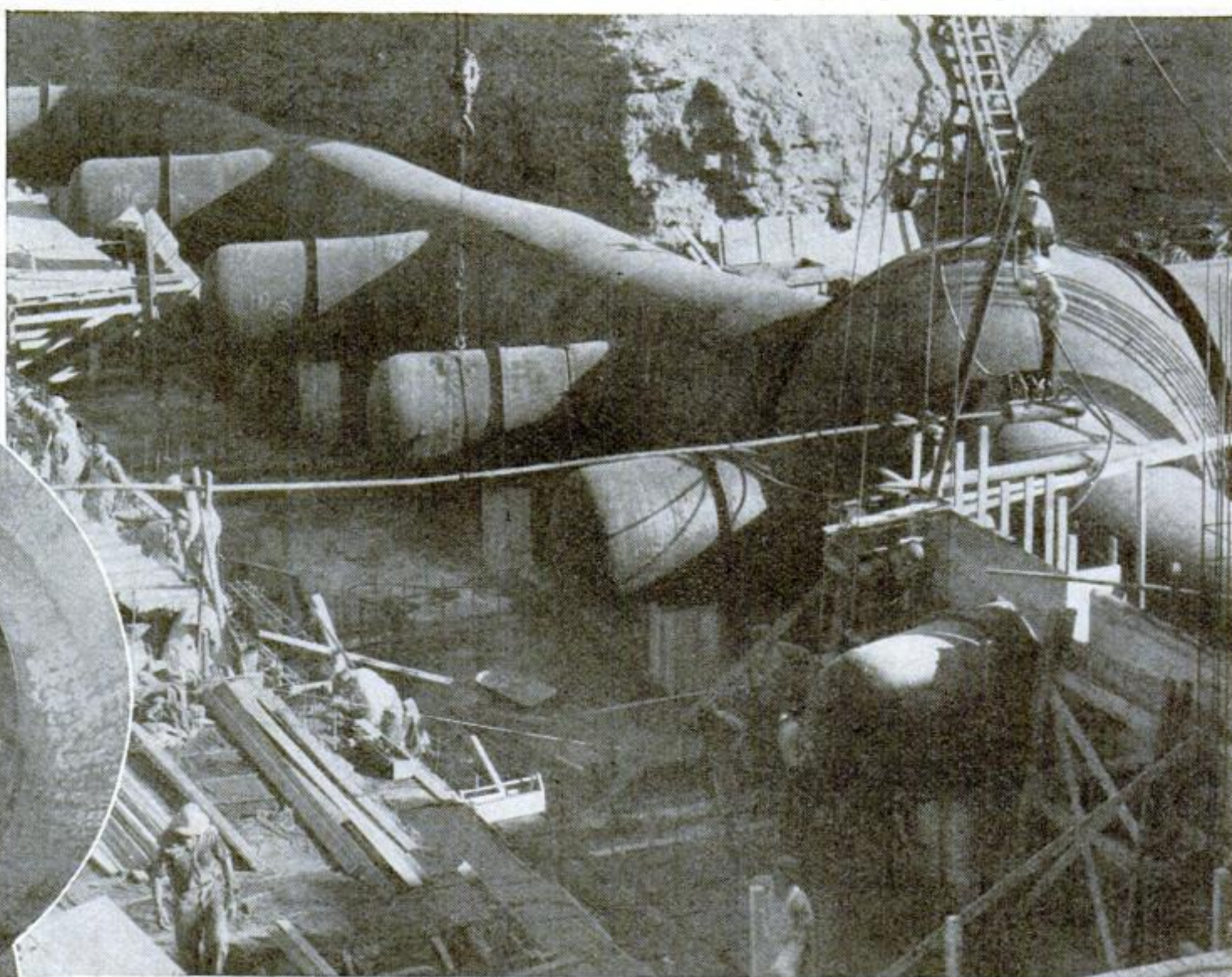
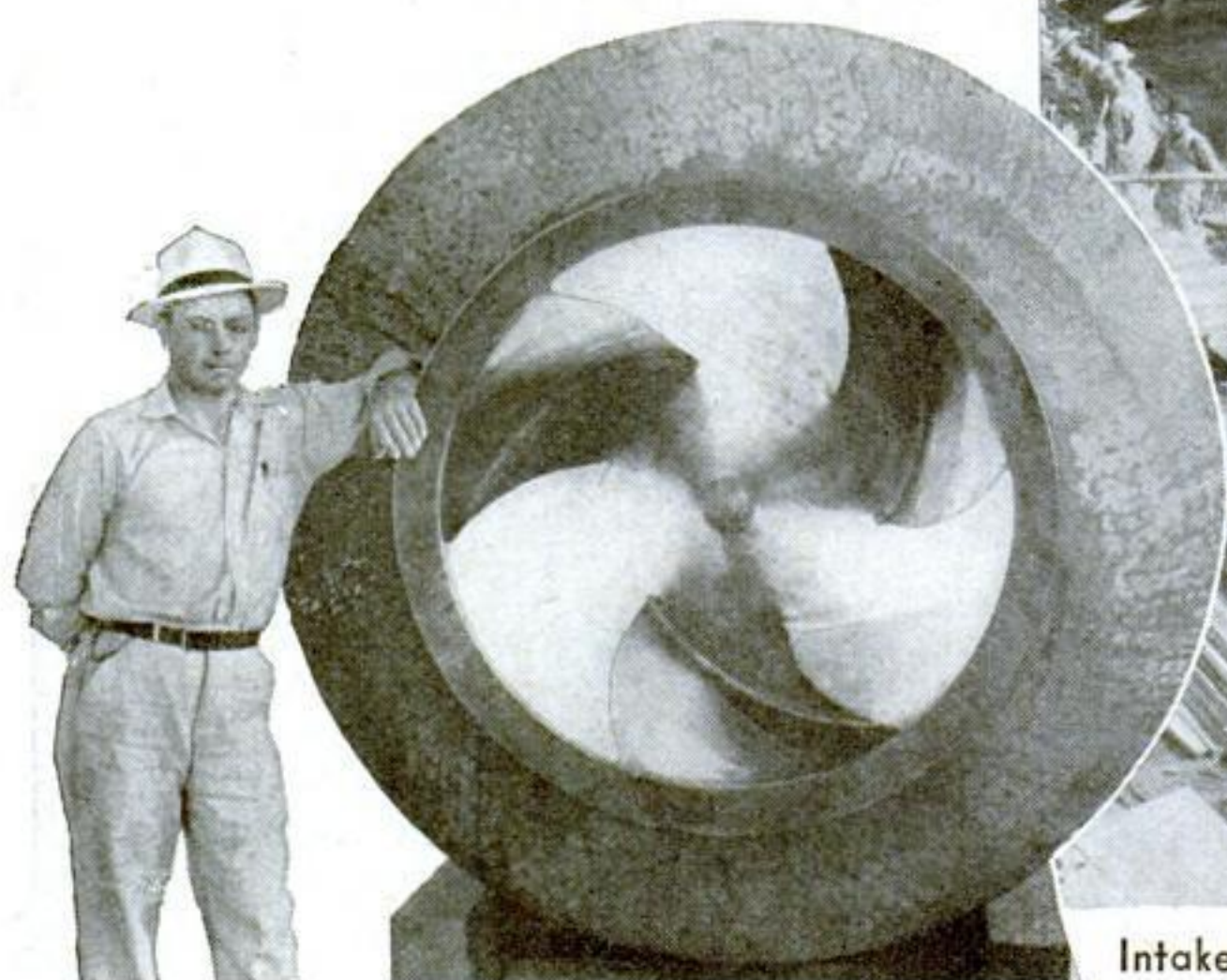
Lumber Miners Dig Old Logs from Swamp



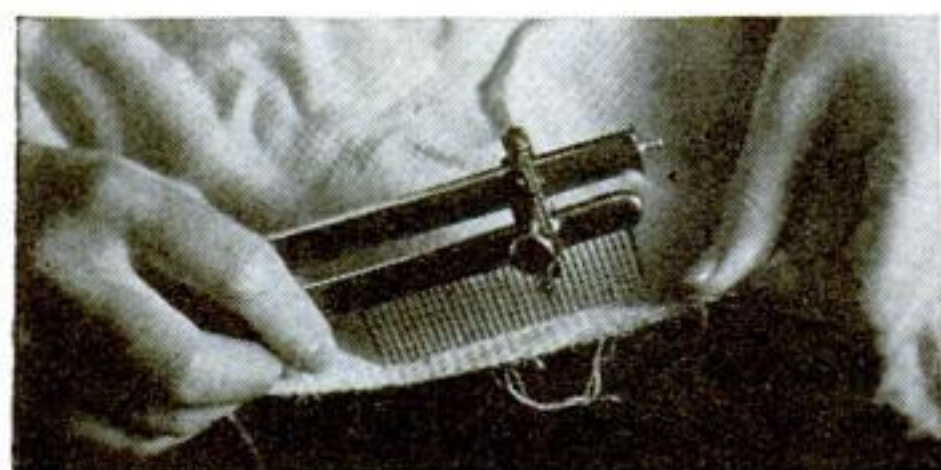
MINING cedar logs has become a thriving industry at Mauricetown, in southern New Jersey. Thousands of tree trunks worth \$50 to \$150 apiece have lain buried for 500 years beneath five to ten feet of black muck, still retaining their bark and the characteristic aroma of white cedar. Hauled out of the marshes, they yield shingles that are declared virtually indestructible by the action of weather.

Mammoth Pumps Installed for Water-Supply System

CAPABLE of flooding an area the size of Rhode Island with a foot of water in only 262 days, nine of the world's largest pumps have just been installed in the new Colorado River Aqueduct. Fed by electric power from Boulder Dam, they will daily hoist 1,000,000,000 gallons of water 1,617 feet over the mountains from the Colorado River to Cajalco Reservoir in California.



Intake manifold and pump foundations under construction. At the left is one of the impellers



Novel Rayon Needle Uses Liquid Thread

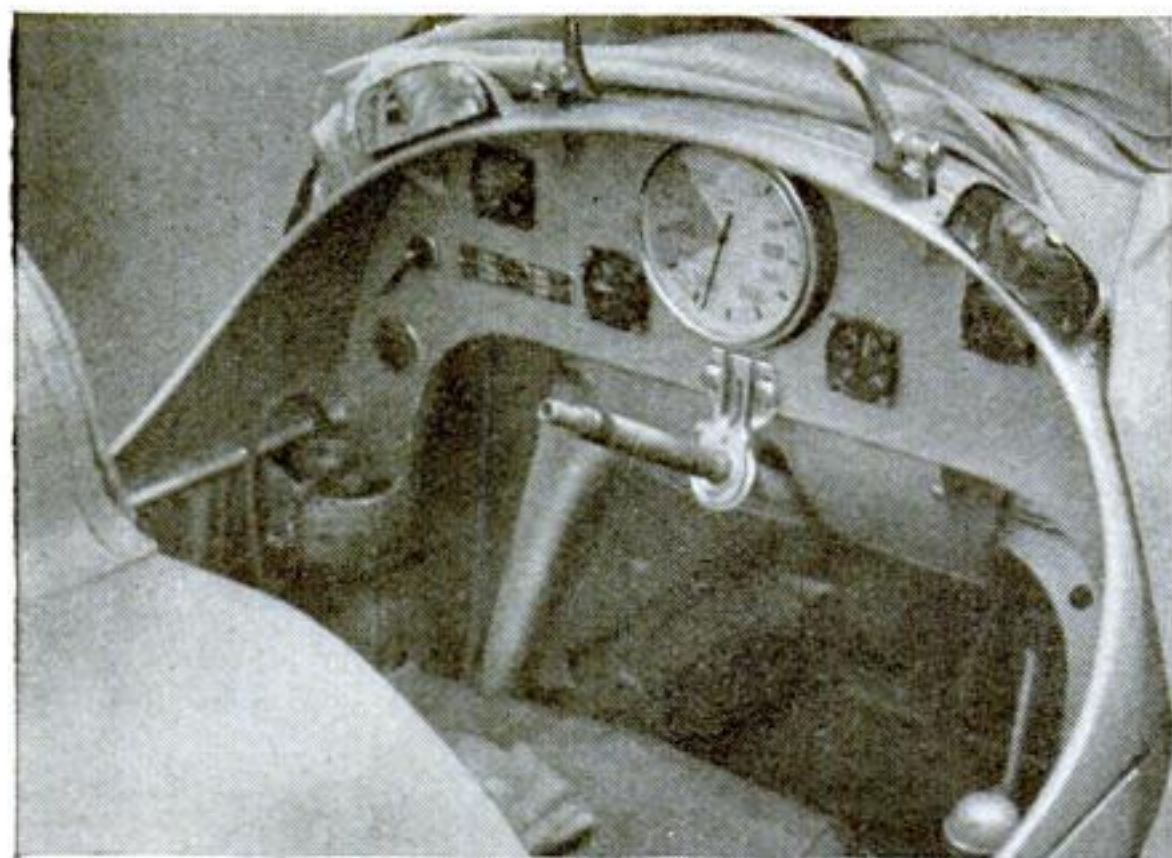
SEWING with liquid thread is a novelty made possible by an ingenious needle of new design. Shaped like a comb, it carries a reservoir containing rayon, or artificial silk, in fluid form. The liquid emerges at the tips of the comb's hollow teeth, solidifying into a strong thread as soon as it comes in contact with the air. By turning a regulating screw, the thread is made fine or thick.

Historic Old Roads Reproduced

HISTORIC roads and highways are being reproduced for display in a permanent exhibition at Dearborn, Mich. The photograph shows A. O. Bray, British consular official, pouring gravel taken from the original road onto a sectional counterpart of the famous Grand Trunk Road between India and Afghanistan, a road in use for almost 3,000 years.



Gravel from a famous road being poured on its reproduction in exhibit



Cockpit of new racing car with steering wheel removed so the driver can get in. Note the water bottle and tube for drinking

Racing Car Has Engine Mounted Behind

SO SMALL is the cockpit of a recently constructed rear-engined racing car that the steering wheel has to be removed to admit the driver. To reduce wind resistance,

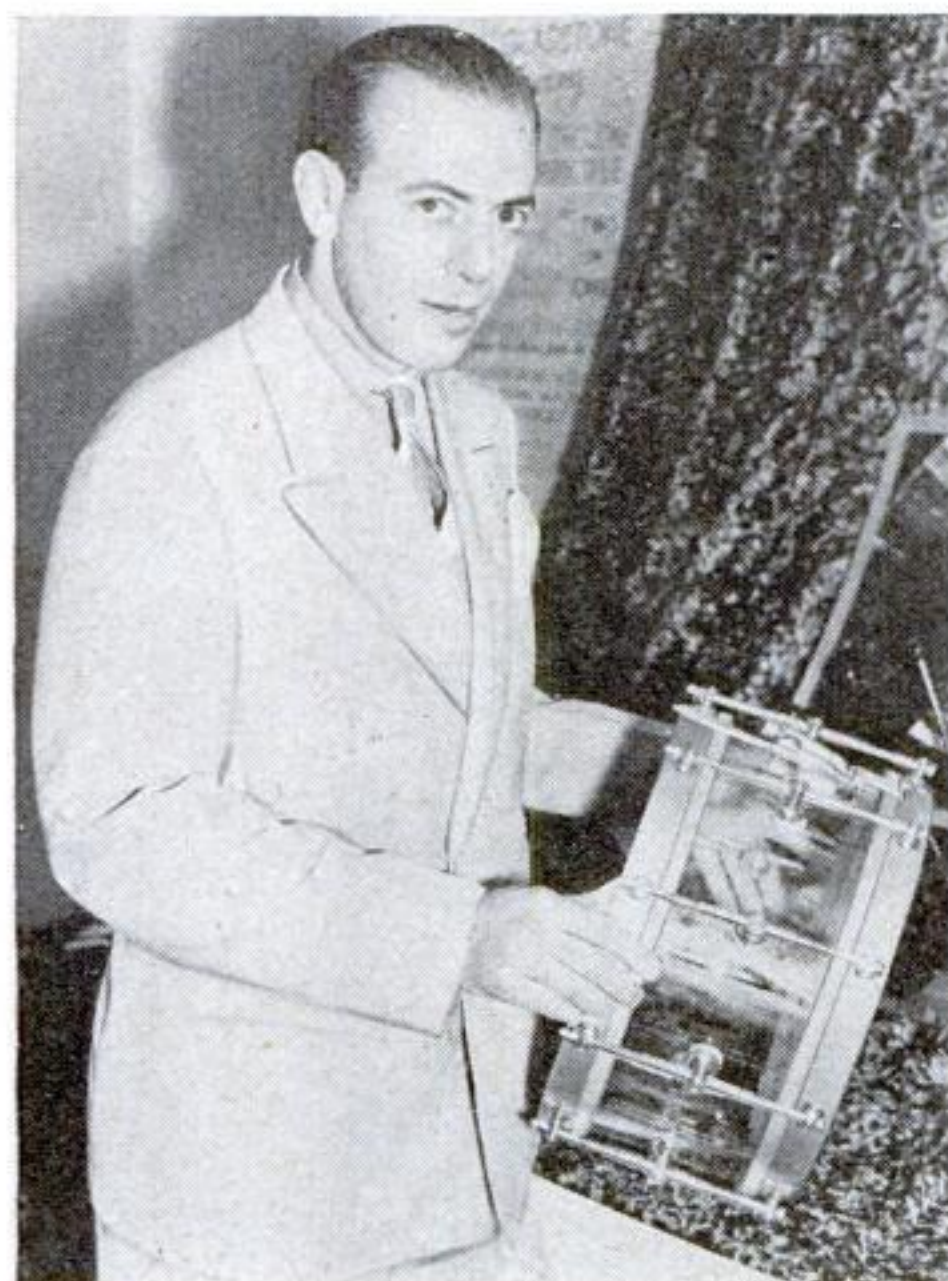
even the rear-view mirrors on the cowlings have been streamlined. A built-in water bottle fitted with a rubber tube and mouthpiece assuages the driver's thirst.



The racer in action. The long, tapering tail houses the car's power plant

Novel Drum is Built With Sides of Glass

A DRUM with a shell of glass, constructed as a novelty by a Brooklyn, N. Y., musical-instrument firm, surprised the builders by the excellence of its tone. Now tests are being made to learn whether glass drums surpass wooden and metal ones for radio use.



Good tone is a feature of this glass drum

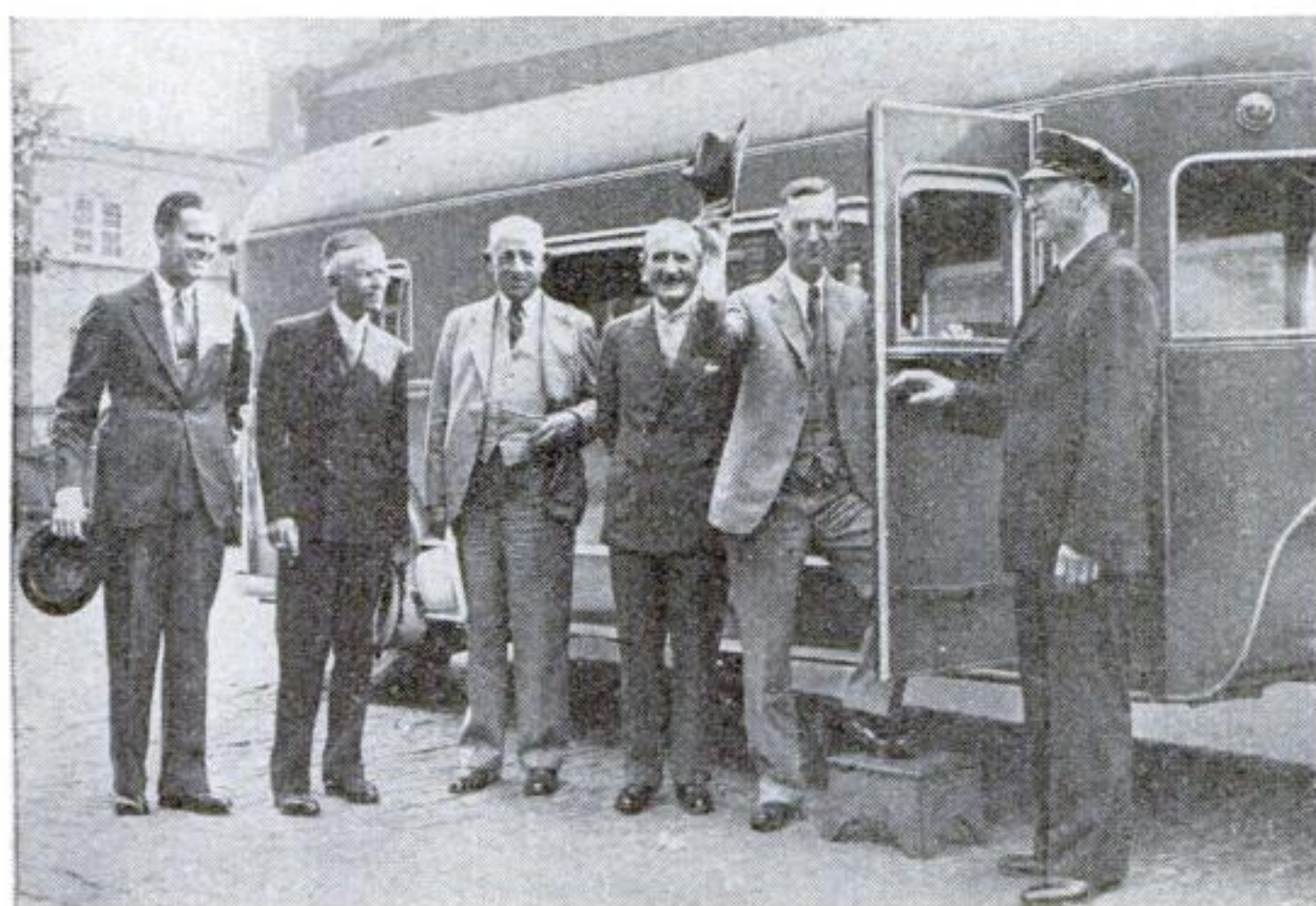


Mechanical Hobbyhorses Race on Boardwalk

RACING hobbyhorses have made their appearance in competitions upon the boardwalk at the seashore resort of Atlantic City, N. J. Propelled by foot

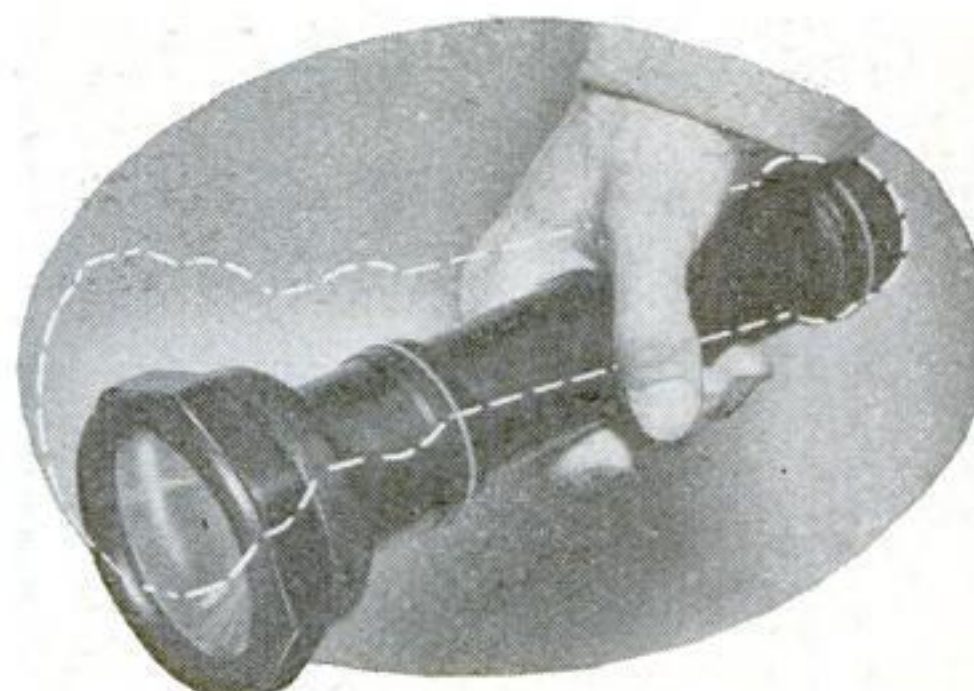
pedals, the three-wheeled mechanical mounts not only attain a lively pace but also imitate the motion of a galloping horse.

Business Men Commute in Auto Trailer



The five business men prepare to leave for home in their trailer

COMMUTING in an automobile trailer, five business men of Newark, N. J., share the services of a single chauffeur to reach their desks in comfort. The commodious vehicle calls for them in the morning and brings them home at the end of the day's work, thus being made useful during the time when it is not being employed for a vacation or travel cruise.

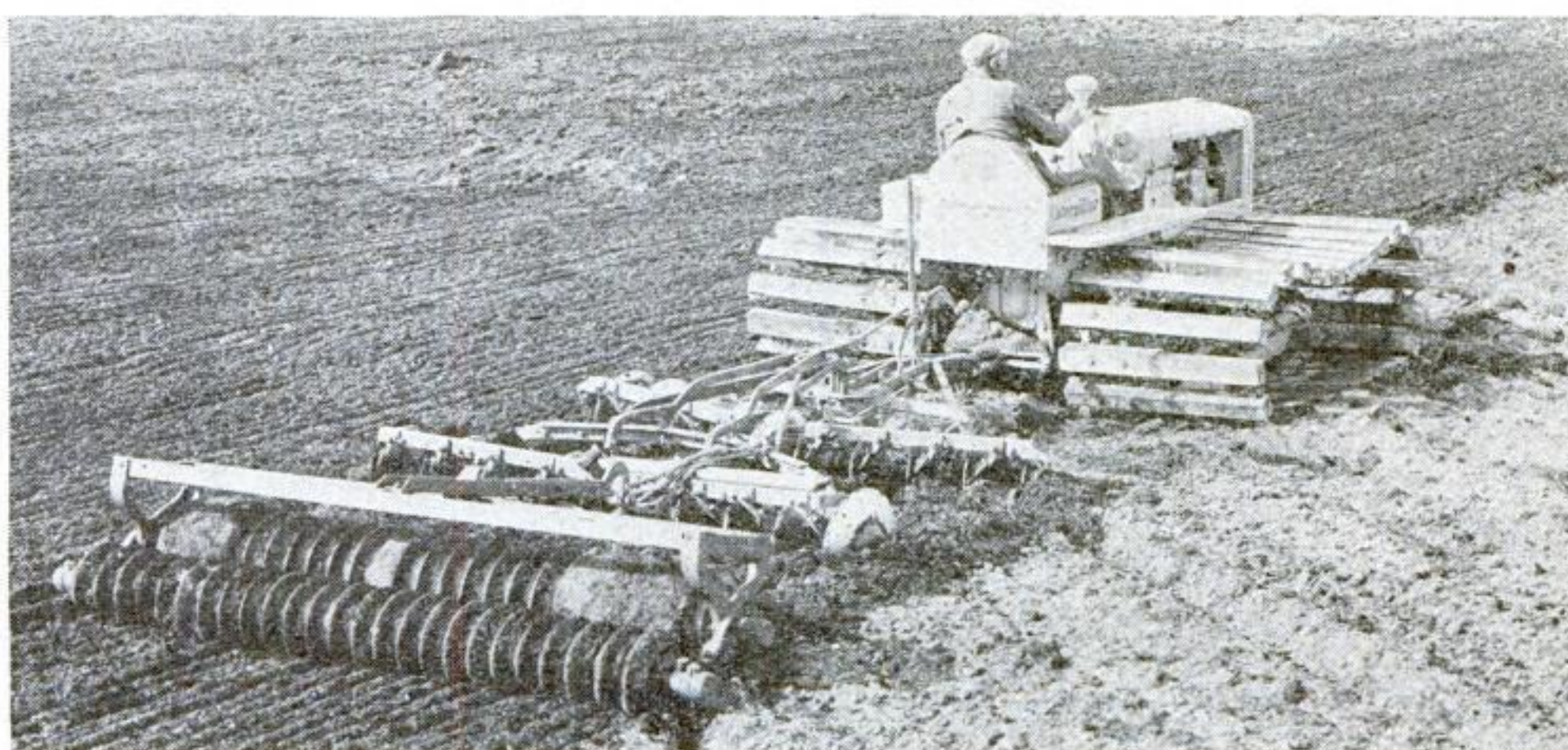


Shake of Wrist Lights Waterproof Flash Lamp

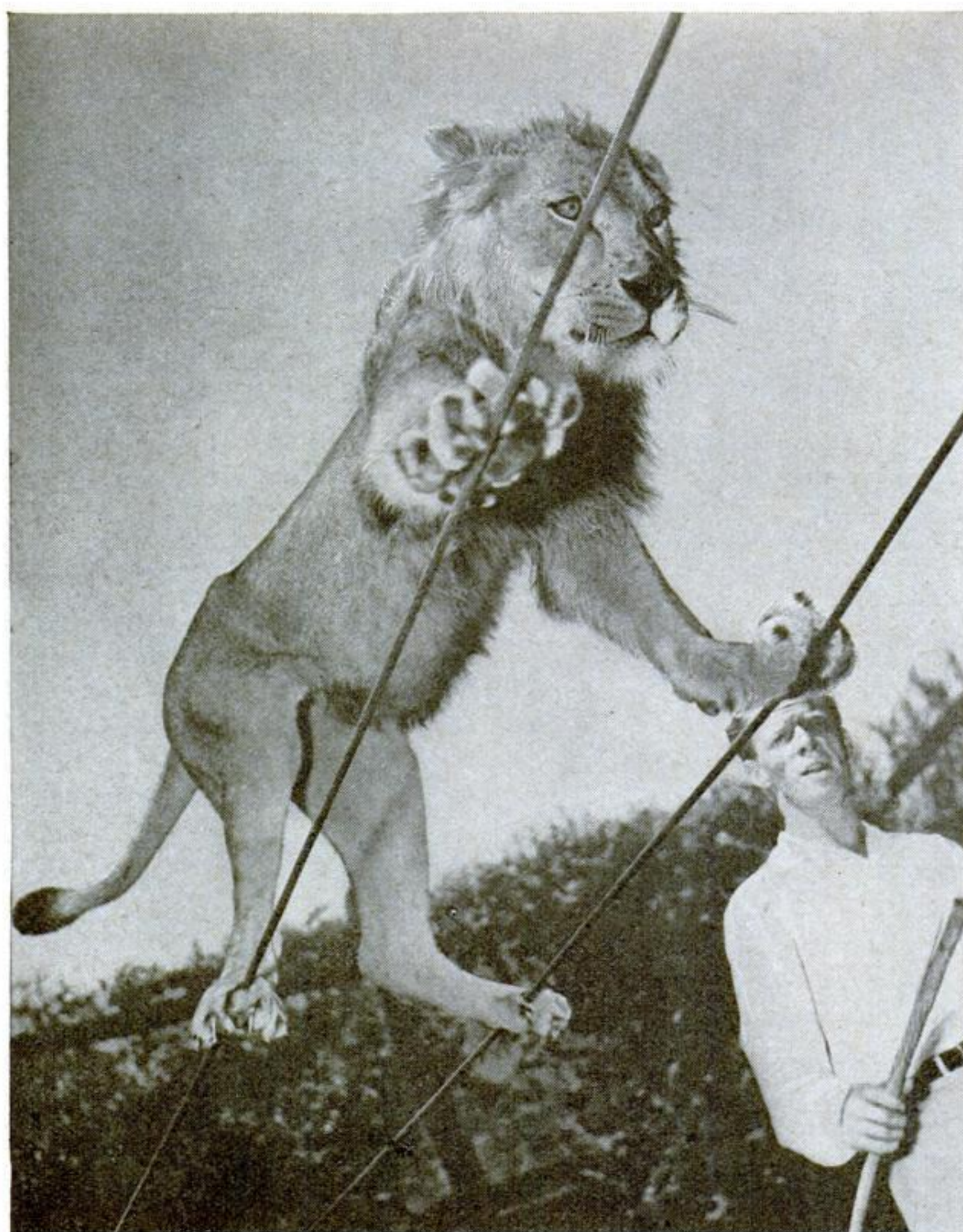
INTENDED for use on lifeboats and in mines, a new flash light has its battery, switch, and bulb sealed within a shell impervious to water and inflammable vapors. One snap of the wrist lights it; another puts it out.

Wide-Treaded Tractor Operates in Soft Soil

TREADING more lightly than a cat, by actual calculation in pounds to the square inch of pressure, a new farm tractor has been designed especially for use in soft, yielding soil. Special over-size treads of three-foot width are said to distribute the weight of the machine so evenly that it will stay on top of the softest ground, without packing the earth and forming ruts. The illustration at right shows the tractor at work on muck land near Grant, Mich., pulling a heavy eight-foot disk harrow and cultivator. It is expected to find wide use on yielding soil.

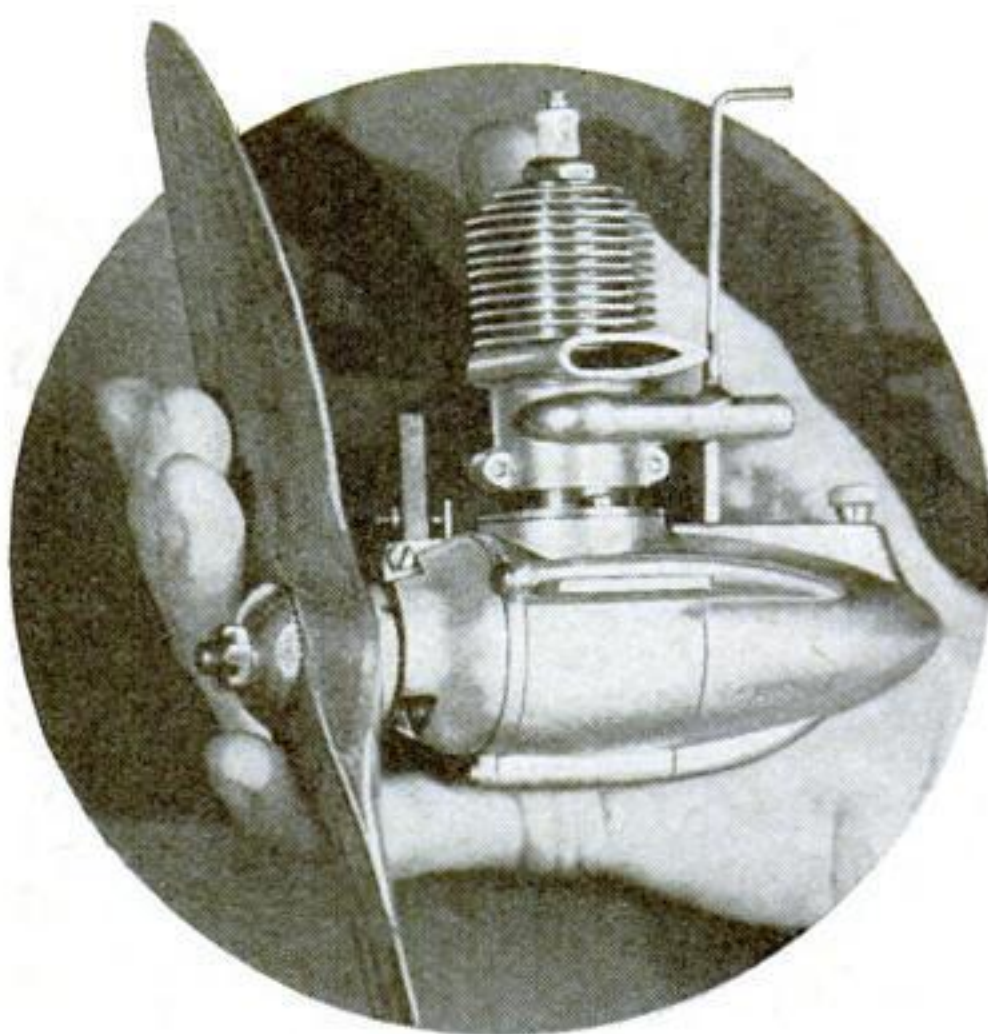


An ordinary house cat actually treads on the ground more heavily than this special tractor



Trained Lion Does Rope-Walking Stunt

BALANCING himself on two cables stretched eight feet above the ground, Aladdin, a 250-pound lion owned by a Californian, performs the difficult feat of wire-walking, as shown above. The animal mastered the stunt after only two months of training.



Model Airplanes Get Streamline Engine

A STREAMLINE, gasoline-powered engine will soon be placed in production as a power plant for model airplanes. Weighing less than one pound, the diminutive motor has one cylinder and is rated at approximately one fifth of one horsepower. A bullet-shaped shell serves as the fuel tank. The engine is capable of turning over at a rate of 10,000 revolutions a minute.

Iodine Comes in Form of Solid Pencil

PACKED in a waterproof case, a new antiseptic pencil is made of iodine in solid rather than liquid form. The tip of the handy antiseptic stick dissolves when it is dipped in water or brought into contact with blood in a wound.

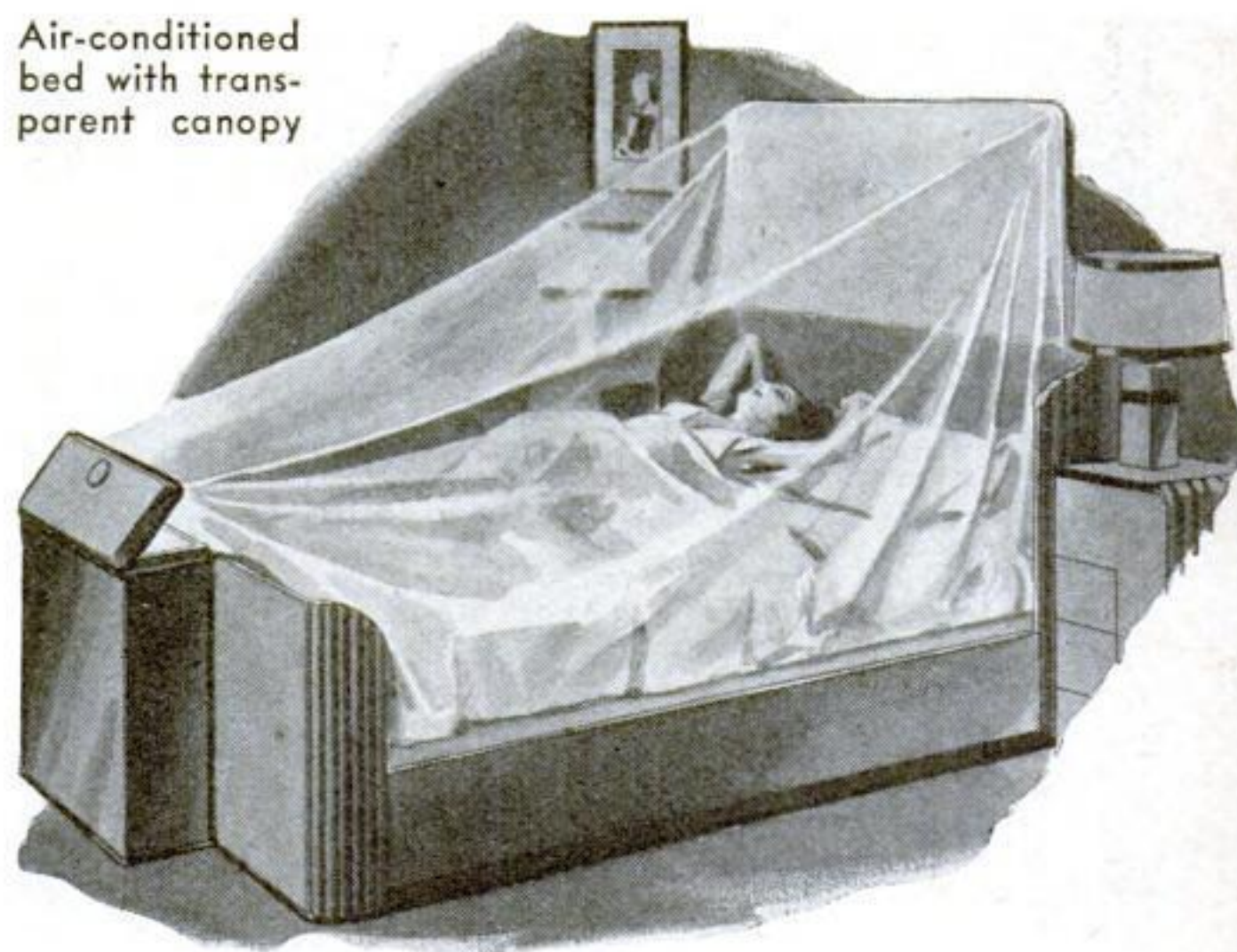


The antiseptic pencil being applied to a cut. The tip dissolves when dipped in water

Bed Canopy Is Transparent

COMPLETELY transparent, a new cellulose material replaces the opaque fabric formerly used for canopies over beds equipped with air-conditioning apparatus. Because of the unobstructed vision a person using the bed has no shut-in feeling.

Air-conditioned bed with transparent canopy



City Boys Camp Out on Roof of Building

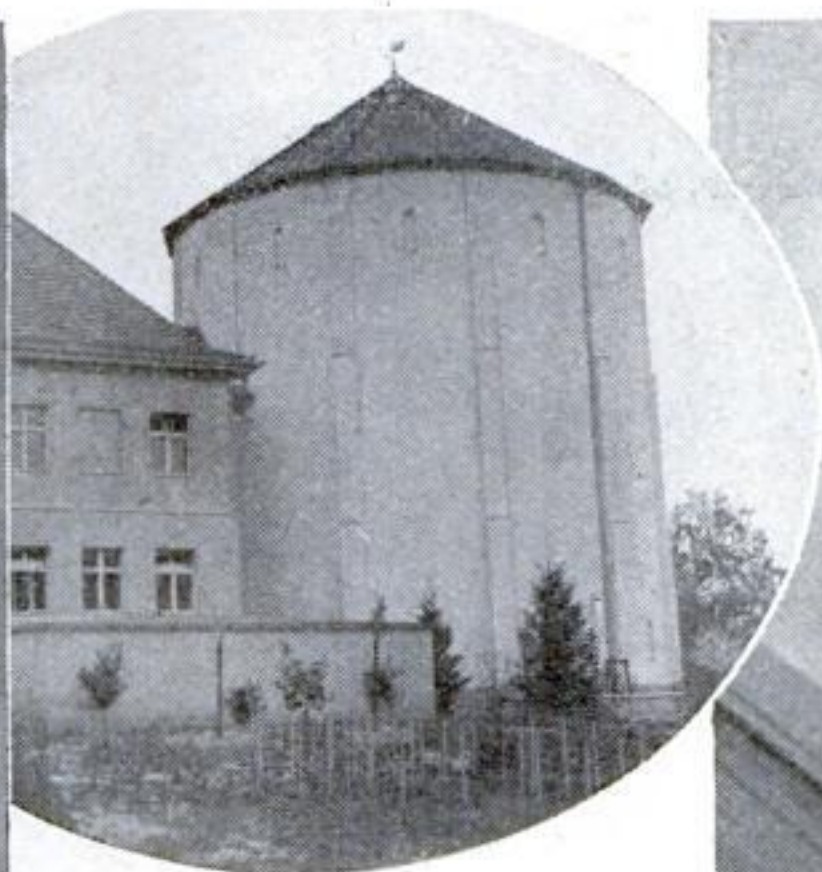
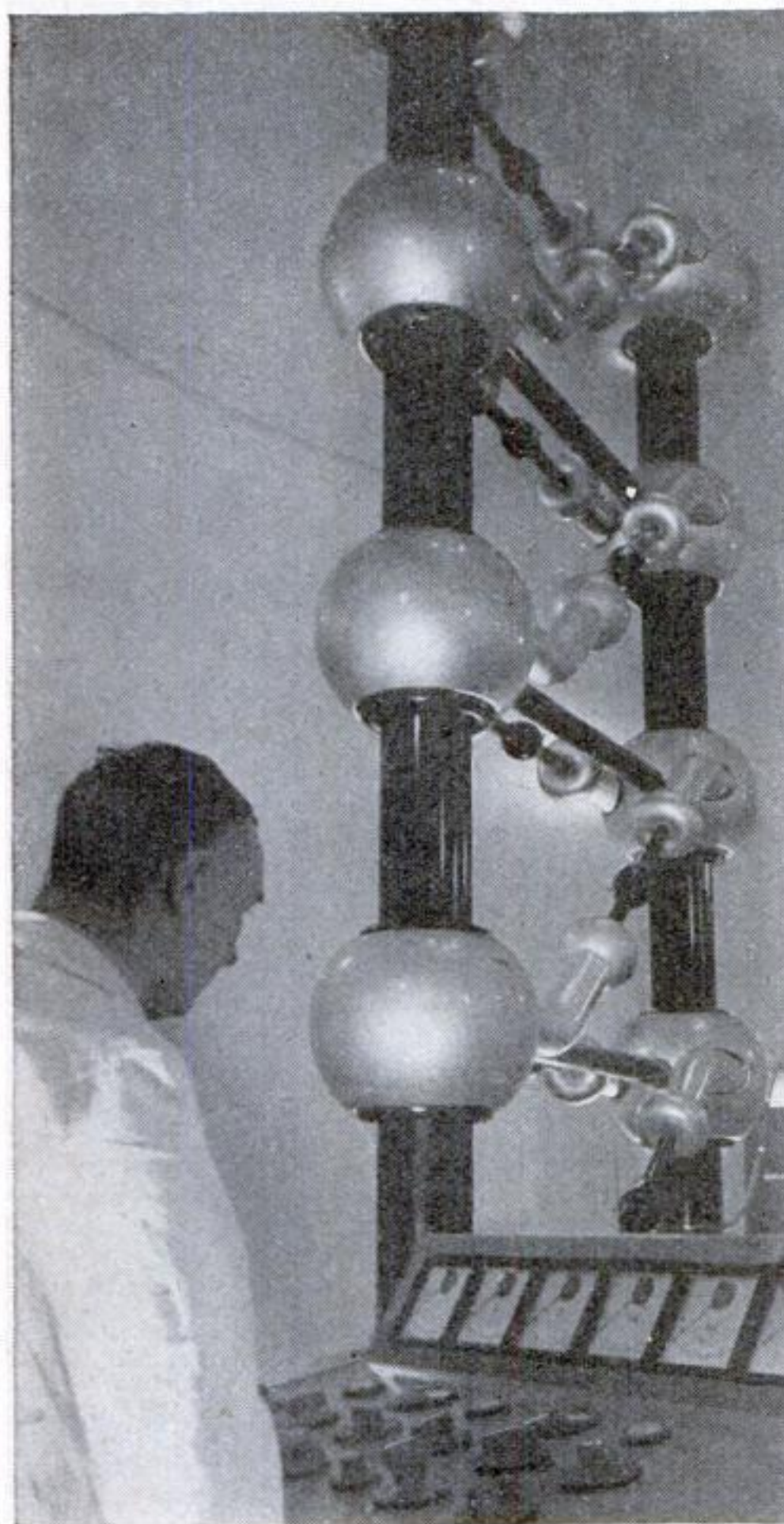
PUP TENTS, canteens, camp fires, and rustic furniture contrast oddly with a skyscraper background as members of a youth organization camp out on a

roof in the heart of New York City. Reclining on mats of artificial grass, the boys carry on various woodcraft activities in their urban surroundings.

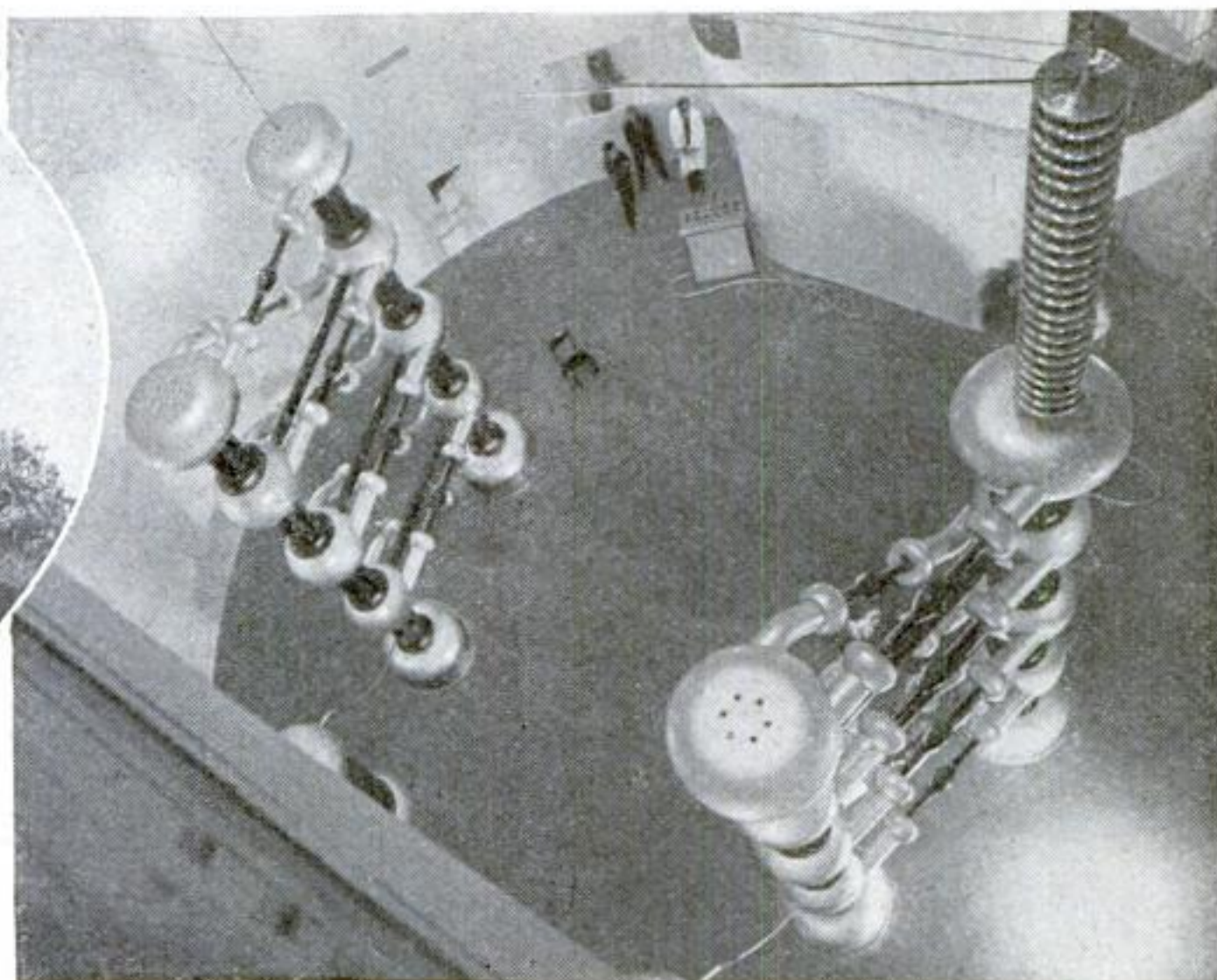


These boys are enjoying the thrill of living outdoors in the midst of New York's skyscrapers

World's Biggest Atom Smasher Uses 3,000,000 Volts

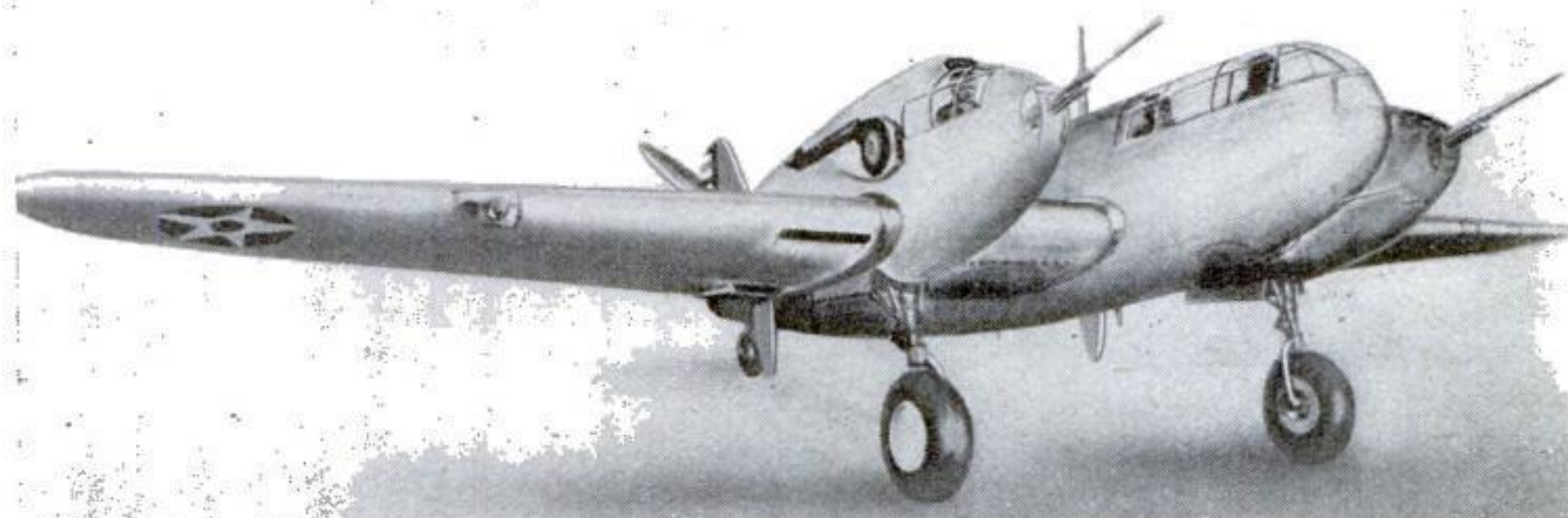


Two views of the new German machine for atom research. Above is the odd, windowless tower in which the experiments are made



HOUSED in an odd, windowless structure that resembles an oversize farm silo, an electrical installation that is termed the world's largest atom smasher is now undergoing extensive tests by German scientists at the Emperor Wilhelm Institute of Physics in Berlin. Two sets of giant electrodes towering more than fifty feet into the air form the gap across which mammoth bolts of man-made lightning leap as more than 3,000,000 volts of electricity are

unleashed. Constructed of pipelike insulators that give them a fantastic appearance, the electrode towers are equipped with ventilating tubes to draw off part of the tremendous heat generated by the electric current. Elaborate safety precautions are taken each time the machine is used. After setting switches and levers on the master control board, the experimenters retire behind protective windows of thick glass and don tinted goggles to safeguard their eyes against the blinding glare.



New Army Bomber Has Propellers Behind

CARRYING six guns in addition to rack-fuls of bombs, a new five-seat bomber just completed for the U.S. Army is termed the most formidable fighting plane ever constructed. The flying for-

tress is powered by two engines driving pusher-type propellers mounted behind the wings. Pilots, observers, and gunners in each wing thus have an unobstructed forward view.

Diver Hunts Sea Monster

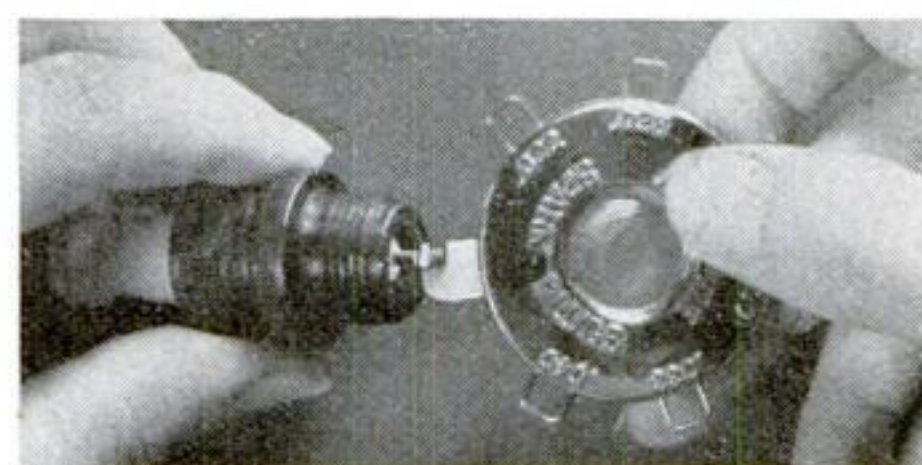
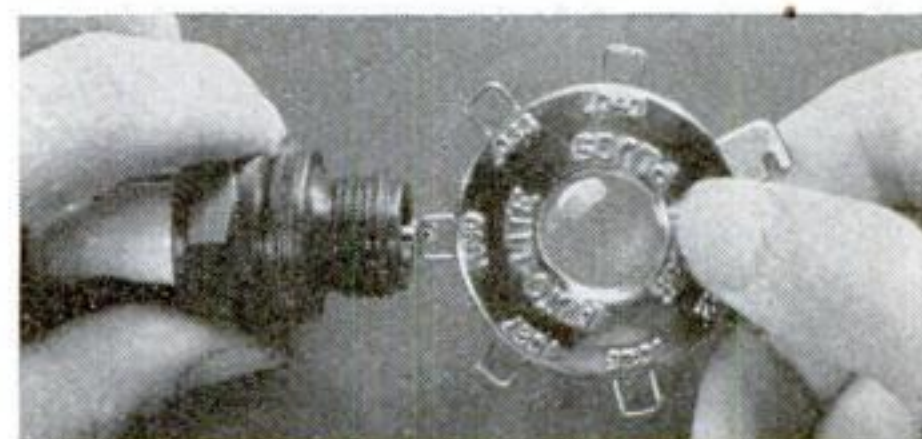
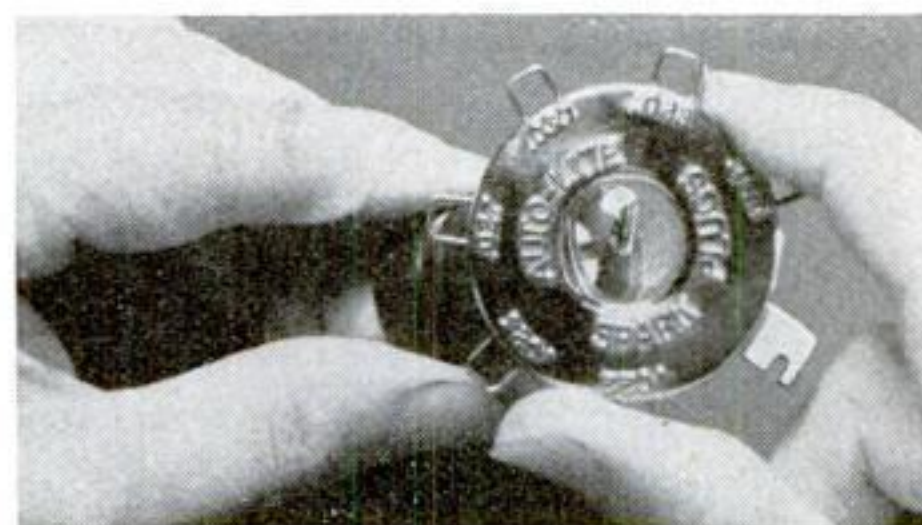
REPORTS of a weird aquatic monster in the waters of White River in Arkansas led to the curious event pictured at the right. Armed with an eight-foot, steel spear, a professional diver clad in rubber suit and helmet was lowered to the river bottom in an attempt to locate the strange creature. So far, however, no explanation of the rumors has been discovered.



Charles B. Brown preparing to stalk the supposed sea serpent

Lens Is Built into Spark-Plug Adjuster

THICKNESS gauges in six sizes encircle a disk-shaped tool just introduced for checking and adjusting automobile spark-plug gaps. A magnifying glass in the disk center facilitates examination, and gaps are adjusted with a hook fastened to the device.



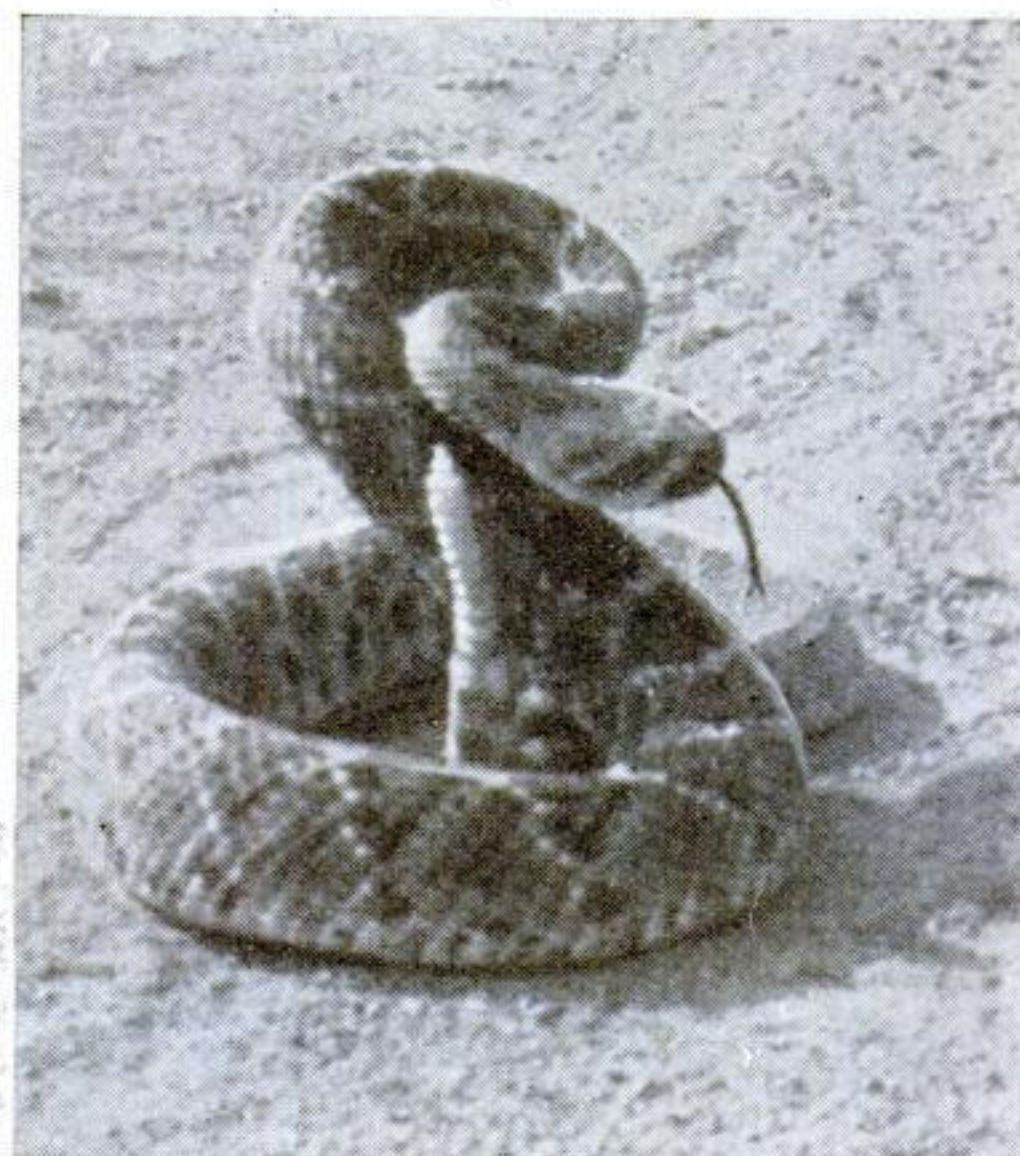
This spark-plug tool includes a lens for examining points, measuring prongs in six sizes, and a hook for making the adjustments needed



Snake Hunter

CATCHES RATTLES FOR FUN

Capt. Donavin Miller capturing a California red rattler on a metal coat hook fitted onto the end of a long bamboo stick



This unusual view shows a rattlesnake as it gets ready to strike. When it lunges, the mouth will be open, the fangs straight

By ANDREW R. BOONE

HOW FAR can snakes see and hear? Which rattlers are most vicious? Do they ever strike before rattling? How do their fangs penetrate victims? Are some humans immune to rattlesnake poison?

Five years ago Capt. Donavin Miller, once America's youngest Army officer and now collector of animals for the California Zoölogical Society, asked himself these questions.

To find the answers, he began stalking deadly rattlers. For 119 weeks he lived among the serpents of the western deserts. He captured 600 rattlers of eleven species, two other varieties of little known poisonous snakes, and a score of Gila monsters. Further to satisfy his curiosity, he took to his Los Angeles laboratory some 600 nonpoisonous reptiles and lizards for study.

By automobile and with pack mules, he explored Death Valley, the Colorado Desert, the Armagosa Desert, and the Mohave Desert in California; "los desiertos" of Arizona and New Mexico; and some little-known but exceedingly hot areas of Nevada. He saw deadly rattlers killed in mortal combats with gophers and birds; he goaded them to the point of frenzy, so that he could take stirring action photographs of strikes; he learned at the risk of his life how rattlers live, obtain their food, and protect themselves against their enemies.

Many times Miller tested the vision and hearing of rattlers. He found they can hear farther through their tongues than they can see.

It was in the middle of Death Valley that he first tried the vision test. Coming across a large diamond-back early one morning, he stopped the car and ordered his two assistants to take up positions seventy-five feet away from the reptile, one on each side of the snake. Miller took a position



Miller holds the sack while a helper places an unusually large red rattler inside it

directly in front of the rattler.

Slowly waving large colored handkerchiefs, the three moved toward the snake. Not until they approached within twenty feet did the reptile raise its head and look directly at Miller. At that instant, Miller and one assistant paused, while the other continued wigwagging. Quickly, the snake looked in his direction. The trick

was repeated, and each time the snake looked in the direction of the movement.

Each time Miller tried this experiment at twenty feet, the head would go up and the tongue out. But hearing? Not so good.

"Snakes hear through the tongue," he told me, as I stood recently on the Mohave desert alongside a small box in which three California red rattlers

buzzed their objection to captivity while he sought to photograph another of their kind in the act of striking. "Sounds reach them through vibration. I'll demonstrate."

Leaving the big snake to its own devices, he took a revolver from his pocket and walked 100 feet away. There he stopped, waited a moment until the reptile calmed down, and then fired a shot. The rattler took no notice. Twenty-five feet closer, Miller fired again, and once more at fifty feet. The snake paid no attention. Then Miller moved in about twenty feet and discharged the weapon again. Now the snake jerked its head upward, and the forked tongue shot out.

Miller walked over to me. "When a rattler's preoccupied, he may ignore sounds even closer than thirty feet," he said. "If one is crawling into a tree—"

"Do rattlers climb?" I interrupted.

"Often, when they are hungry. I watched a yellow Pacific rattler crawl into a mesquite tree about five feet tall the other day. He was after birds' eggs. While he lay stretched out on the branch eating them, I walked up within six feet, clapped my hands, and spoke in a loud voice. He ignored me completely."

"Aside from vision, rattlers sense everything through the tongue. I am sure they cannot smell, for they crawl right over disinfectants which would drive most animals to cover."

Miller has subjected scores of rattlers of all kinds to the "striking test" to determine whether they will strike upward, how easily they may be caused to

To answer common questions about poisonous reptiles, Capt. Donavin Miller has risked his life putting them through strange tests

strike, how often they will strike before returning to a comparatively peaceful state.

Diamond-backs, green prairie rattlers, sidewinders! Those are the vicious babies. Most zoölogists, according to Miller, consider the California red rattler more dangerous than the sidewinder, but observation has shown that the red, notwithstanding its size, is the less vicious. The little sidewinder loses his fierceness in captivity. He is very easily tamed and can be made quite docile.

Miller learned, too, that rattlers do not always advertise a strike with buzzing rattles. Rattlers have struck at him on seven occasions, twice without

rattling, but he has miraculously escaped injury.

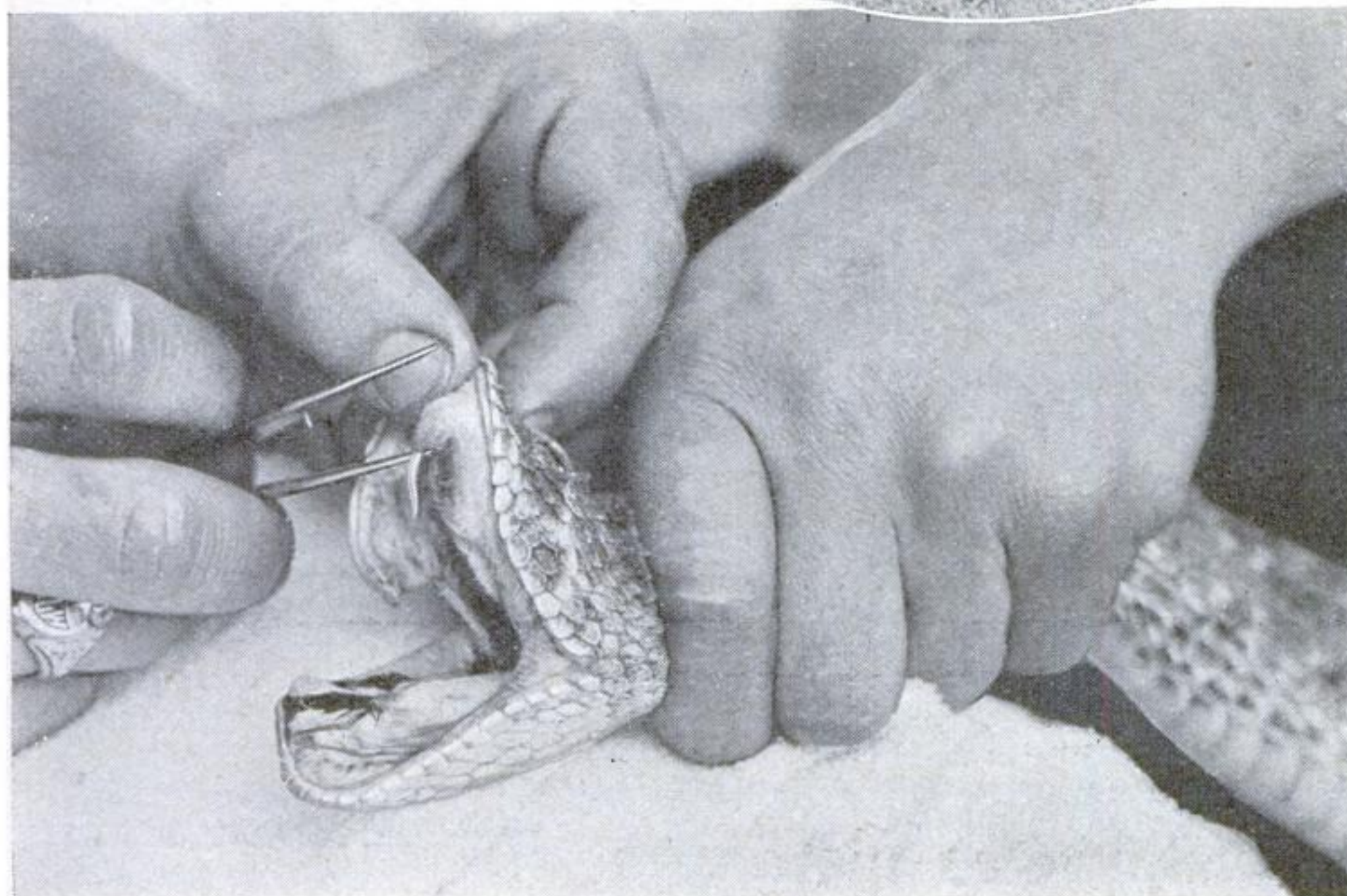
Once he was crawling over the rocks on a hill at the edge of the Colorado Desert, carrying with him a box containing two yellow Pacific rattlers caught earlier that morning near the Salton Sea, when he suddenly came face to face with a diamond-back sunning itself. The reptile arched its body and plunged its head forward only a few inches, spitting venom directly toward his face. "Only the fact that the snake was not coiled saved my life," he declared.

This incident did not deter the snake hunter from his determination to film close-ups of rattlers actually striking. On that expedition, and again in the hills near Saugus, Calif., more than once he operated his small camera with one hand, directly in front of an infuriated snake, while teasing it to strike by waving a handkerchief with the other hand.

He came across a Texas diamond-back late one July afternoon. The snake was sunning itself on the side of a steep hill. Miller took up a position about four feet downhill, focused his camera on the spot, spread his legs to brace himself, and began teasing the rattler. The snake coiled, rattled ominously, and, as Miller was about to click the shutter, lunged forward. Fortunately, the reptile plunged downward as he came toward his tormentor, and fell
(Continued on page 146)



The snake hunter getting an action picture of a rattler's strike. The photograph below shows how a snake's fangs are removed. The reptile dies soon after this is done



A curious test of a snake's hearing. Miller found that a rattler would not notice a pistol shot farther away than thirty feet. Snakes hear through their tongues, feeling vibration of the air

Are You a Good

THIS ARTICLE TELLS HOW TO LOOK FOR

By
ROBERT E. MARTIN

A FEW weeks ago, a gang of silverware thieves in New York City worked out an ingenious ruse for robbing a Park Avenue apartment. The day before the owner was to return from Europe, two of the crooks, dressed as expressmen, delivered a trunk which they said had been sent on ahead. The building superintendent unlocked the apartment for them to put the trunk inside. Half an hour later, they returned and explained that the delivery should have been made to the owner's sister, also returning from Europe, who lived in another apartment house. As they carried out the trunk, they also carried a confederate who had entered the apartment in the trunk and had used the thirty minutes to rifle the rooms of valuables.

The only slip-up in the carefully laid plot was the fact that the building superintendent happened to be one of those rare individuals who possess what detectives term "total recall." He was

able to describe the expressmen minutely, recalling so many details of their appearance that veterans of the burglary squad had little difficulty identifying the gang.

In one of his most celebrated cases, the fictional Sherlock Holmes was aided by a band of observant bootblacks and newsboys. Similarly, the real-life scientific sleuth of today often depends upon amateur observers for tips and clues. A few years ago, an amateur criminologist identified Fred Burke, notorious trigger man of the St. Valentine's-day gang massacre in Chicago, after he had been living quietly for months in a Missouri community. Recently, the slayer of an eastern dentist was captured because another young man habitually played detective and jotted down the number of every out-of-town car parked in the neighborhood.

Imagine yourself witnessing a crime or discovering a murder. How good a detective would *you* be? Would you know how to help the police? Would you know how to pick up a revolver without smudging fingerprints? Would you know the half dozen hot spots of crime detection which supply a majority of scientific clues?

During the past week, I have been talking to detectives, asking them all the same question:

What can an amateur do to help the police? Suggestions that cropped up over and over again are given in this article.

First of all, without disturbing anything at the scene of the crime, keep your eyes open. You may see something that the police will arrive too late to find. For instance:

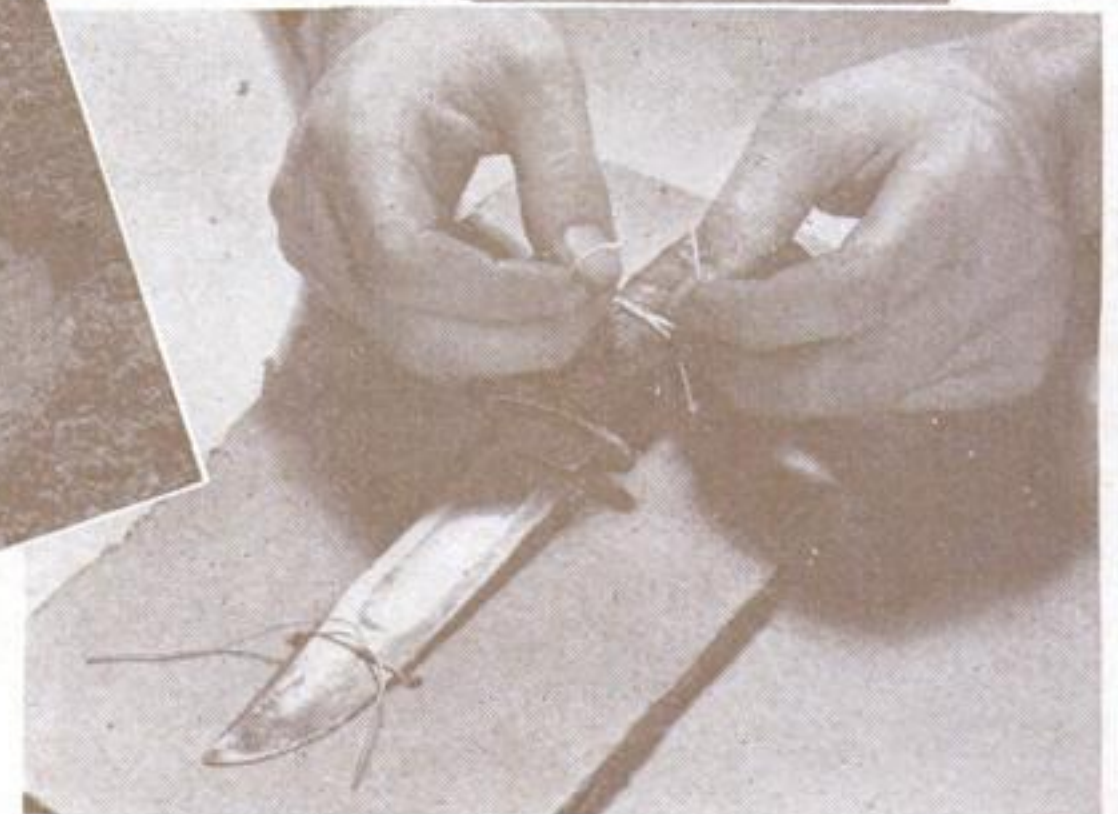
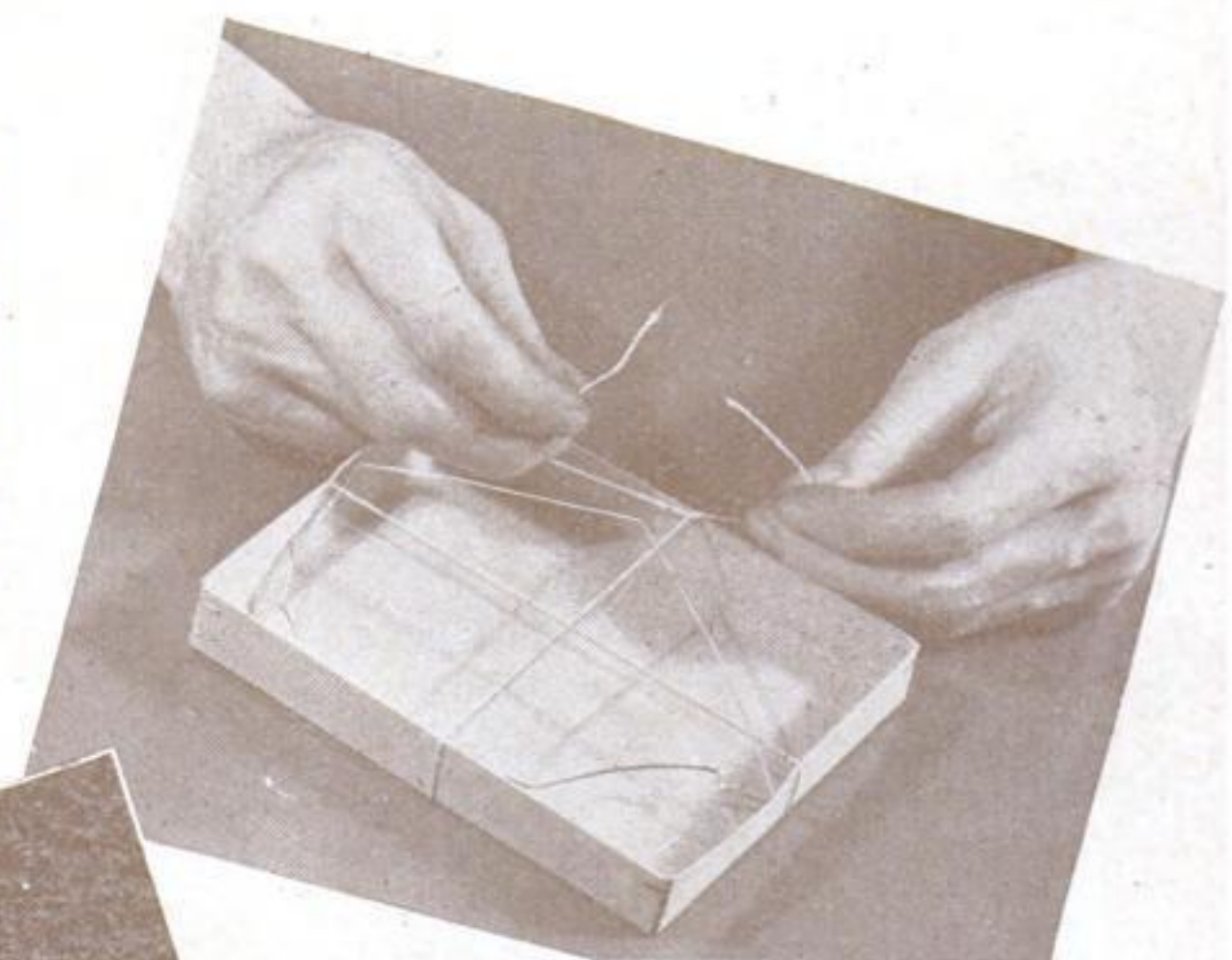
In California, not long ago, a tourist pulled up in front of a cabin seeking water for an overheated radiator. When he knocked, the door swung open on its hinges. Within, the floor boards had been torn up, dirt was scattered about in piles, and slumped across a table was the body of an old man. He had been stabbed a dozen times.

The victim proved to be a former prospector. Rumor had it that gold nuggets were buried under the floor of his shack. It was for this imaginary treasure that some unknown killer had entered the ramshackle dwelling. During the subsequent investigation, it became important to establish the time of the murder. Beside the victim, police had found a cup and saucer. Just before his death it appeared, the old man had poured coffee into the saucer to cool. By the time the police arrived, all the beverage had evaporated, leaving a thin coating of residue on the china. However, the motorist remembered that there had been a teaspoonful or so in the bottom of the saucer when he found the body. This enabled a scientific sleuth to fix the time of the mur-



Powder burns on skin or cloth may supply valuable information for the solving of a crime. Here a detective is examining such marks

Objects that might have fingerprints or other clues must be handled carefully to avoid destroying evidence. At the right are shown ways of preparing a piece of glass and a knife for carrying



Footprints tell tales. In the one at the right, the pencil indicates the part of the foot on which most weight was put

Detective?

CLEWS THAT SOLVE CRIMES

der almost exactly. He refilled the saucer with coffee up to the residue line and then timed the evaporation of the liquid.

During recent months, a new development in criminology has added to the importance of information that amateurs give the police. Detectives now are cataloguing in minute detail the methods employed by underworld mobs. Professional crooks work in different ways, and the manner in which each band operates leaves a sort of fingerprint upon the crime.

A few months ago, for example, a stick-up gang carried out a daring daylight robbery in an eastern city. Forcing their way into a wealthy man's home while he was entertaining guests, the gunmen lined every one up against a wall and then made their get-away with more than \$100,000 worth of jewelry. Within thirty minutes, detectives were on the trail of these crooks because the host remembered one seemingly inconsequential fact. He had received a "wrong number" call on his telephone a few minutes before the hold-up occurred. That call was the fingerprint of a particular gang, which always followed this procedure to make sure an intended victim was at home.

If you ever witness a hold-up or robbery, or are the victim, the police are sure to ask you such questions as these: Were the criminals calm and professional, or jumpy and amateurish? Which crook gave the orders? Did the gang exhibit any peculiarities such as smoking or eating while committing the crime? At what time did they arrive, and when did they leave? This last question is highly important. It may help overthrow fake alibis later on.

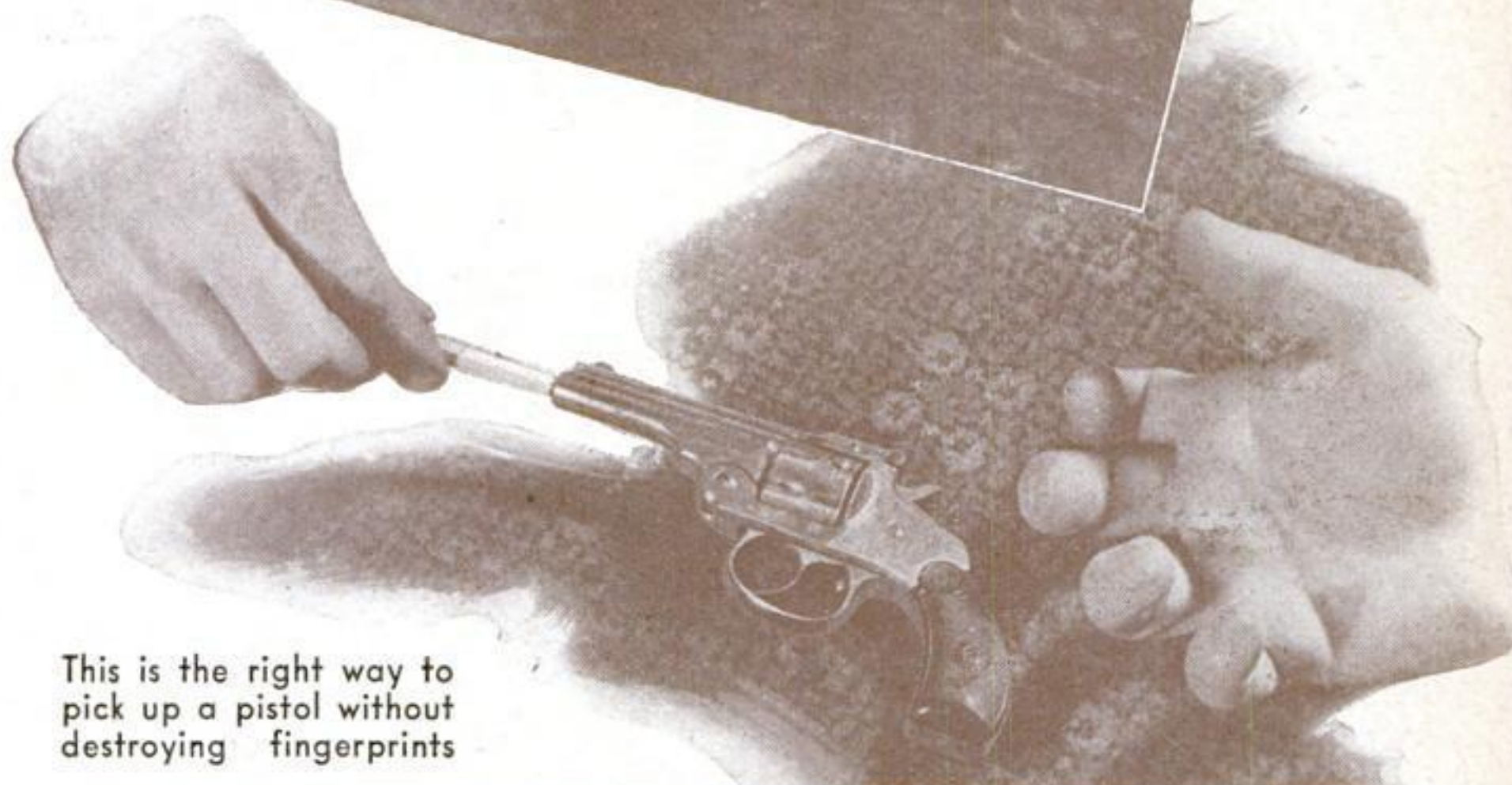
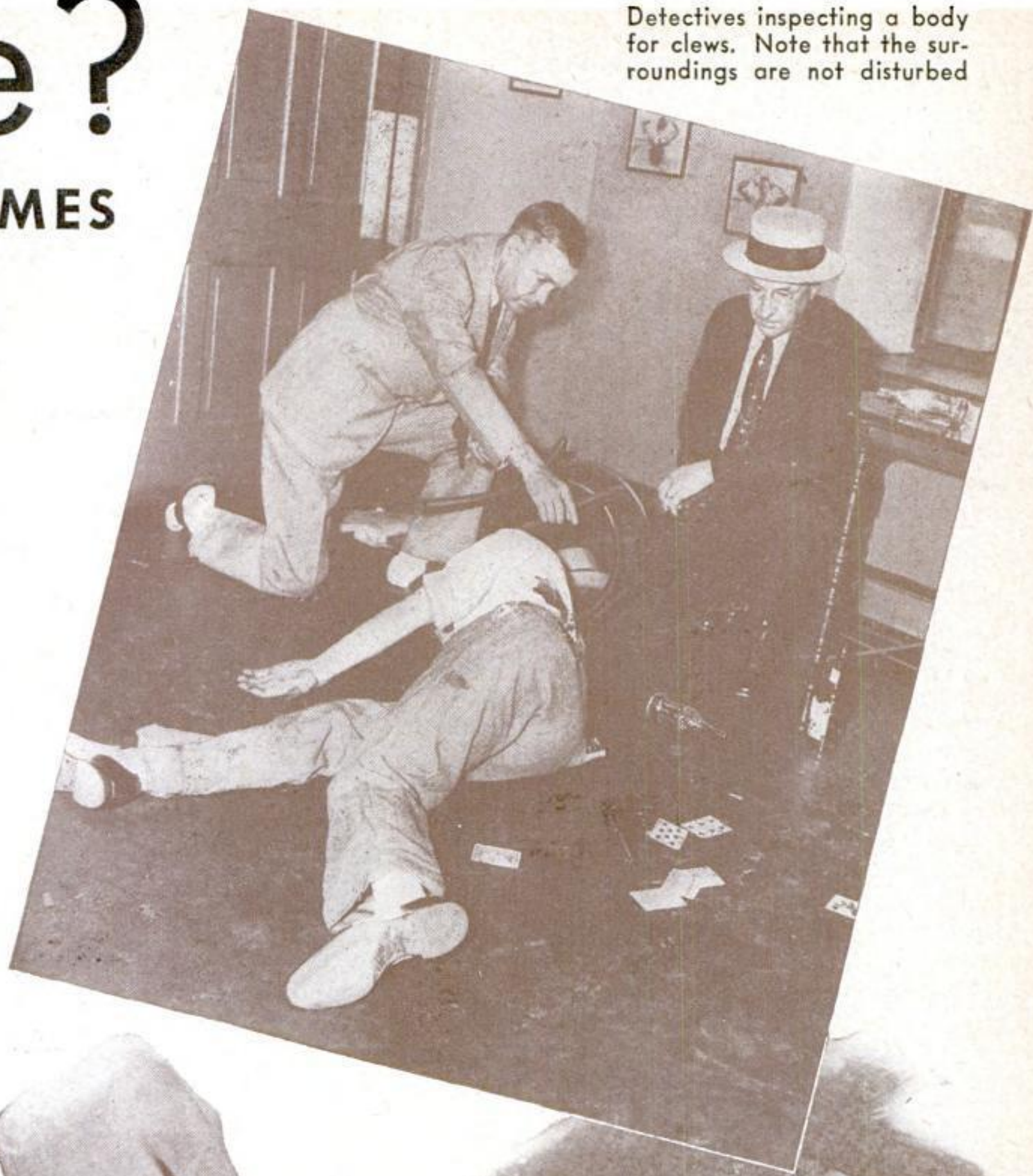
In case you have time to notice only one feature of a criminal's face for later identification, one detective told me, choose the nose. This is the facial characteristic most likely to be recognized after a lapse of time. A few concrete points are more valuable for identification purposes than many general impressions. Consequently, whenever possible, get exact information by checking up on your senses.

An analysis of 20,000 answers to questions has shown that the average person will overestimate the height of a man by almost five inches, will get the color of his hair wrong eighty-three percent of the time, and will think he is about eight years older than he really is. I once saw forty detectives tested for their ability to judge time. They sat still for several minutes and then estimated the time that had elapsed. There was a 400-percent variation in their answers. Through long experience, the police have learned that the observations of the best-intentioned witnesses are apt to be far from exact. They know, for example, that a man dressed in a light suit always appears larger than he is, when seen in the dusk, and that a medium-sized man walking between two small men always will be described as tall.

In one case, an alert filling-station attendant was able to give the police the exact height of a bandit because he noted that his eye met a spot on the wall of a near-by building when he looked over the criminal's head. Measuring distances, noting exact times, and checking up on your senses in general will help you give concrete and valuable information to the police.

Whenever you see a mystery movie, you see the Hollywood sleuth carefully wrap his handkerchief around a revolver before he picks it up. This is supposed to prevent the destruction of fingerprints. As

Detectives inspecting a body for clues. Note that the surroundings are not disturbed



This is the right way to pick up a pistol without destroying fingerprints



A fingerprint expert examining articles found at the scene of a murder. Any object that the criminal touched may supply the clue to his identity

a matter of fact, smudged prints are likely to result. Real scientific detectives slip a pencil in the muzzle of the revolver when they wish to lift it from a floor or table. Thus, no part of the outside of the gun is touched.

In case it is necessary to transport a revolver or other weapon for any distance, place it on a piece of cardboard, punch four holes in the backing, and with two loops of cord tie the object to the cardboard. Carried in this way, there is little danger of fingerprints being ruined in transit.

Another fertile source of clues is a knotted string or rope. From a single knot, a modern scientific sleuth can tell much about the unknown person who tied it. Oftentimes, he can discover his occupation and whether he is right or left-handed. So, as an aid to the police, save all strings and cords found near the scene of a crime. In case you have to loosen a knotted rope, cut it, leaving the knot intact.

In a middle-western city, not long ago, the keen eye of an amateur detective revealed a cold-blooded murder plot by noticing something peculiar about a piece of rope. A banker's wife was found hanged in the basement of her home. She had been in ill health, and all the evidence pointed to suicide—all except some fine fibers on one side of the rope.

The amateur, a near neighbor, no-



A bullet passing through a pane of glass leaves a tiny, craterlike depression on the side opposite that from which it was fired

ticed that the rope, after being passed over the beam, had been tied to an upright post. From the beam halfway down to the post, all the fibers on the underside of the rope pointed back toward the beam, while, on the rest of the rope, they pointed in different directions. That fact revealed that the heavy body had been pulled up after the woman was dead. The banker later confessed that he had smothered his wife and then carried out all the details of the fake suicide.

From the shape, size, and position of blood spots, you often can reconstruct the action of a crime. The greater the distance the drop falls, the more prominent are the splash marks around the edge. Also, if the wounded person is walking or running, the spots will be elongated with smaller splash marks extending in the direction of movement.

Similarly, edible things from which a bite has been taken may provide important clues.

For months, in one southern state, a string of grocery-store robberies kept police on the jump. Reporters dubbed the slippery thief "the sweet-tooth burglar," because in almost every case he left behind a chocolate bar from which he had taken a bite or two. The impression of irregular teeth was the same in every instance. Finally, a transient was brought into police headquarters on a minor charge. One of the detectives noticed his irregular teeth. He was asked to bite into a bar of candy, and a comparison of the impression with moulage casts made from the chocolate found at the scene of one of the burglaries established his guilt.

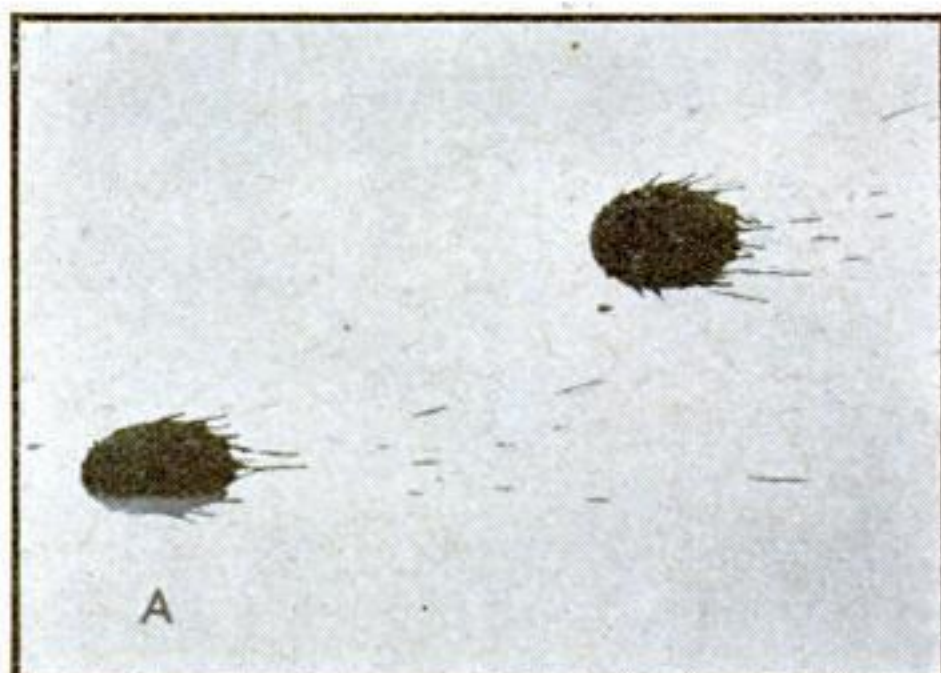
Luke S. May, the noted scientific detective of Seattle, Wash., always carries a small roll of brown wrapping paper with him when he visits the scene of a murder. If he enters a room, he unrolls the paper, beginning at the door, and uses it for a carpet so he will neither track in dirt nor destroy any fragmentary bits of evidence already in the room. Present-day crime detection sometimes hinges upon such fleeting clues as dust and pollen.

A case in point is a western murder. Late one night, an unknown assailant pried open a window in a roadhouse, crept to the (Continued on page 142)

Can You Read These Clues to a Murder Mystery?

HOW good a detective are you? You can test your powers of observation by studying the five clew-photos below. Showing important evidence collected during the investigation of a murder, they offer valuable clues of the type that often help the police to solve baffling crimes. The victim was found murdered with a

bullet wound in his head, and evidence showed that the murderer also was wounded. If you are a good detective, the rest should be easy. Go over the photographs and the descriptions carefully, jot your answers down in the margin, and then turn to page 143 for the correct solutions.



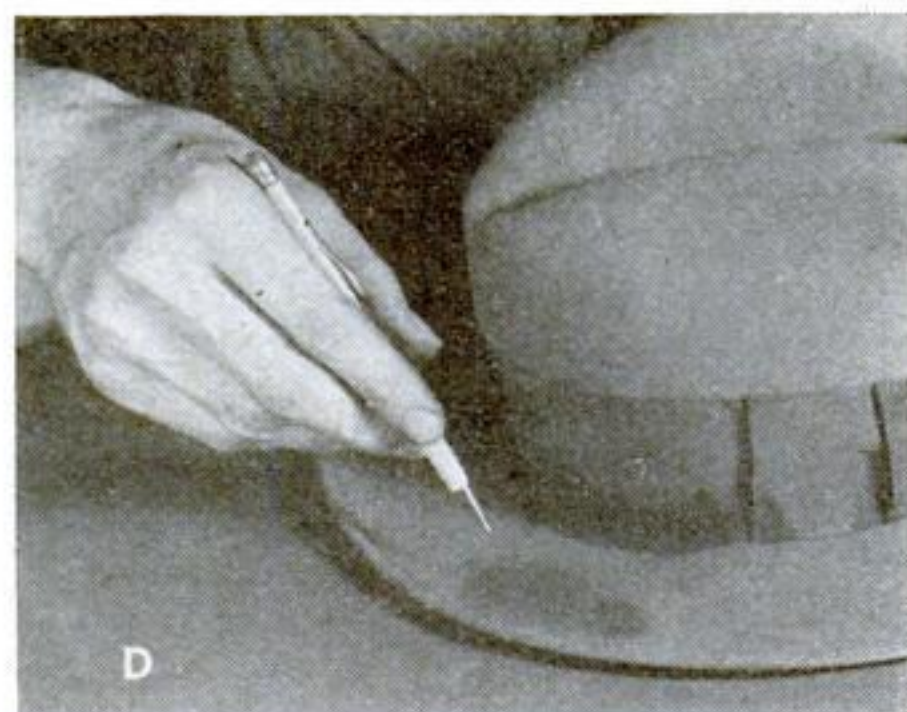
Was the wounded murderer running at the time when these blood drops fell to the floor? If so, which way did he go?



These spots were found beside a ladder. Was the murderer leaning against the ladder or climbing when they fell?



Here is the criminal's footprint found in soft earth. Can you tell, at a glance, if he was walking forward or backward?



This is the criminal's hat, found where he dropped it in fleeing from the scene of the crime. Is its owner a right-handed or left-handed man?



Matches and cigarettes found in a suspect's room. Are the suspect and the murderer similarly handed, or is one right and the other one left-handed?

• Human Guinea Pigs

BREATHE NATURAL GAS TO PROVE IT NONPOISONOUS •



DELIBERATELY exposing four human guinea pigs, as well as six rats and two monkeys, to heavy concentrations of natural gas for varying periods, Dr. D. R. Drury of the University of Southern California School of Medicine has determined in novel experiments that gas as it comes from the earth has little effect on the bodies of either humans or animals.

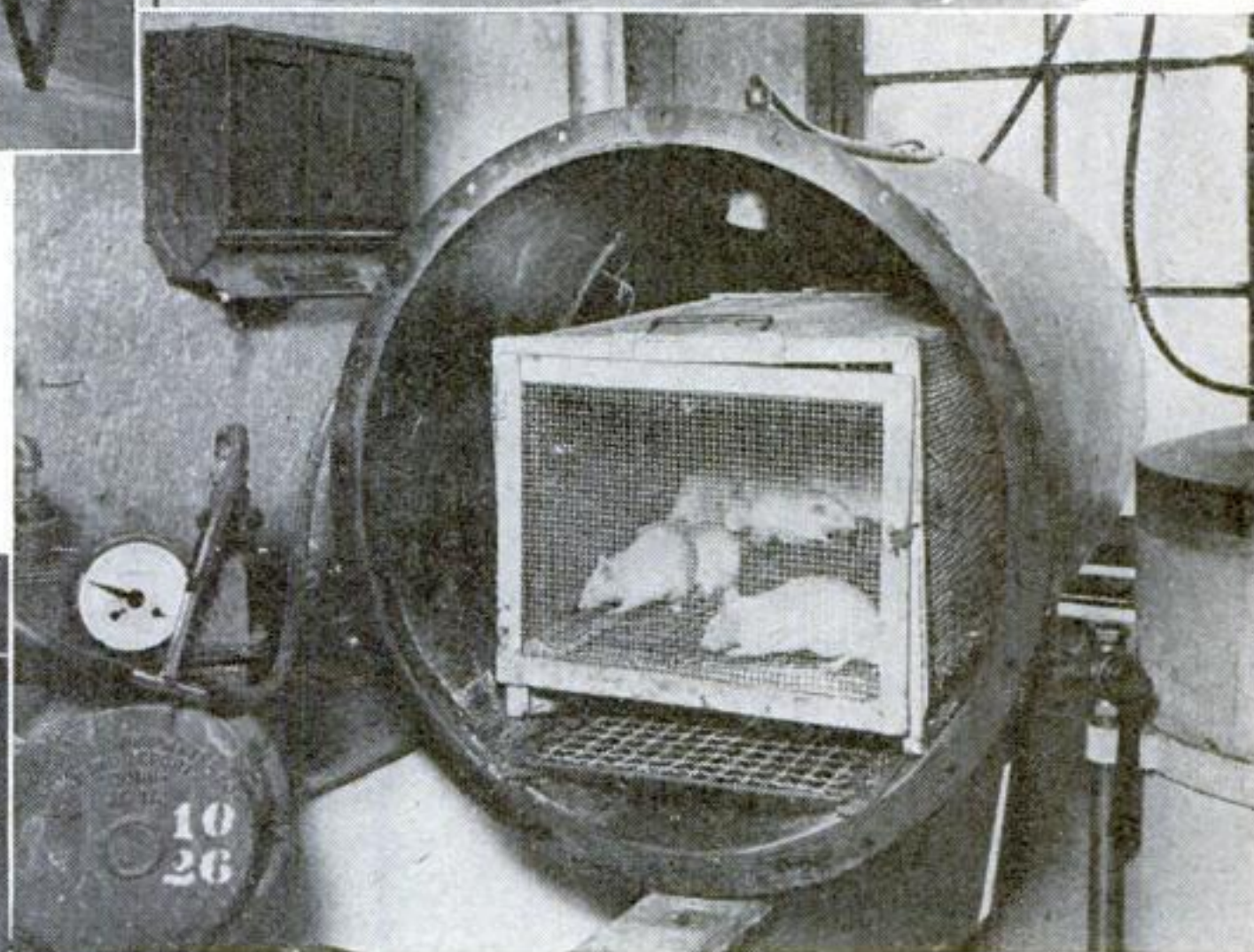
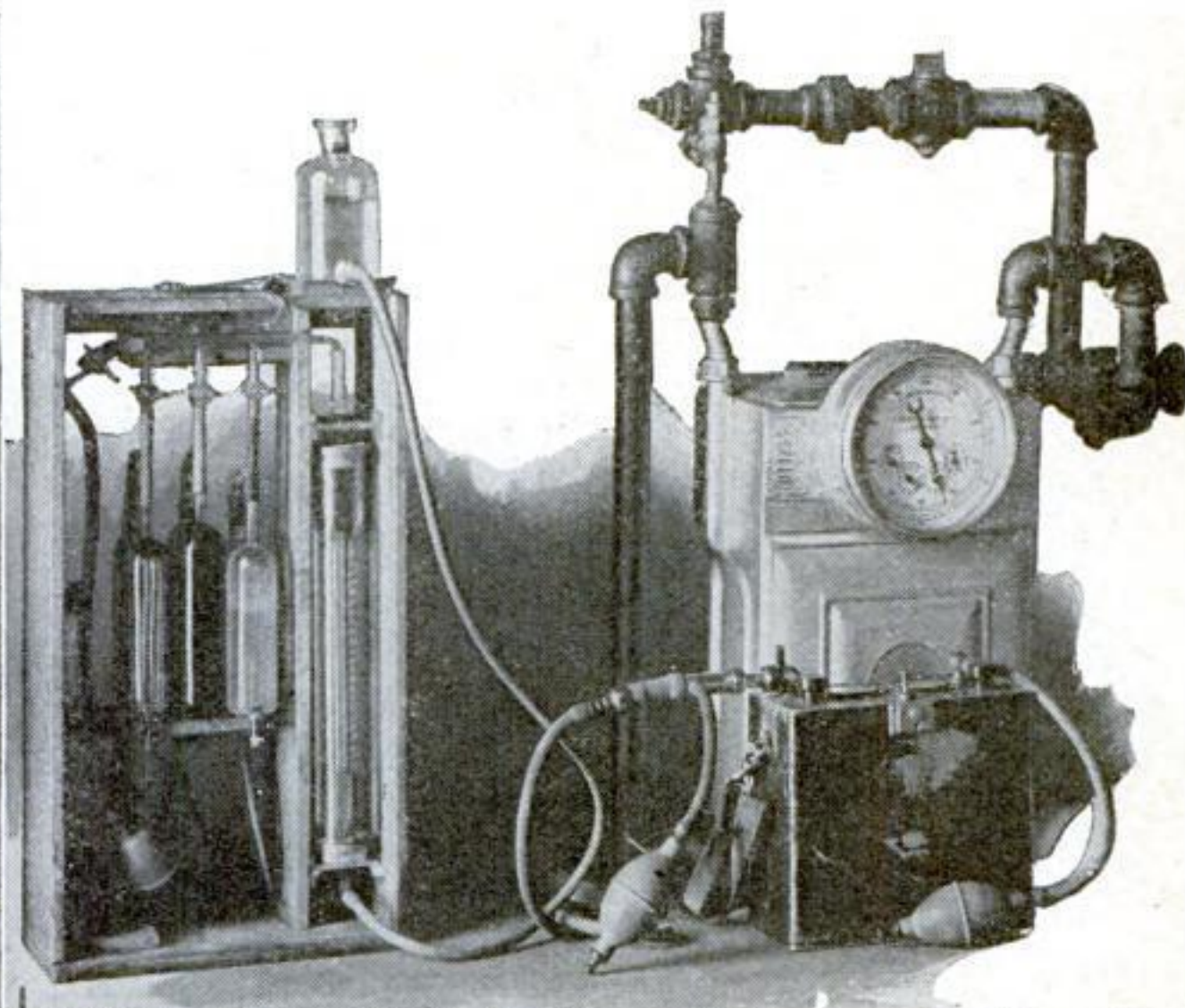
In the first test, six rats were kept in a cylindrical iron tank approximately two feet in diameter and three feet long, fitted at one end with a transparent cover. Gas taken from a domestic supply pipe, and air forced in by pump, were so mixed as to give a gas concentration of eight percent. The rats lived in this mixture for thirty-six days, ate well, and on being removed were clean and healthy. A litter of new-born rats born in the gas chamber were found alive.

In the second experiment, two monkeys were exposed for thirty days in a thirty-percent gas-in-air mixture, and examination showed them to be normal in all respects.

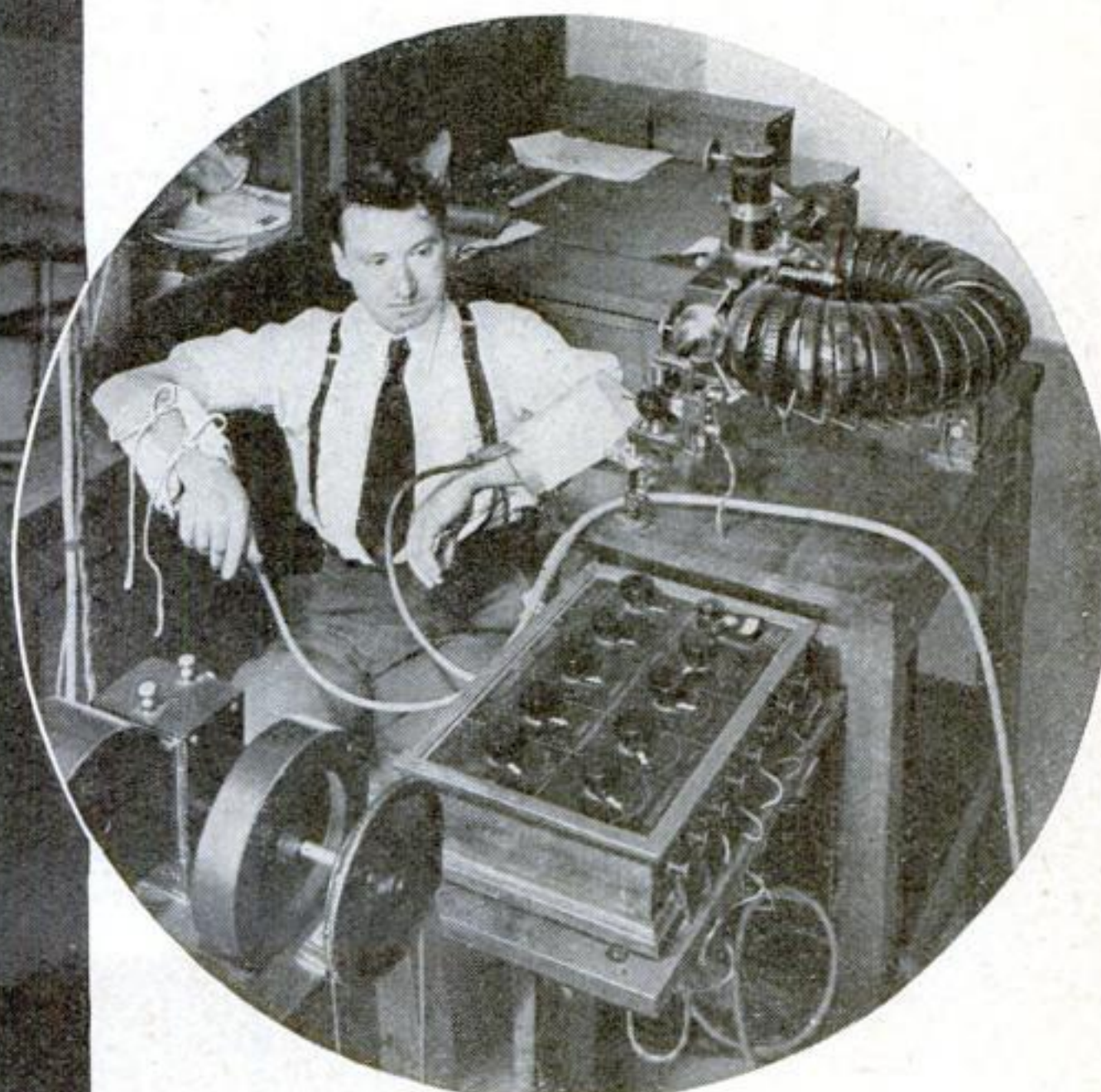
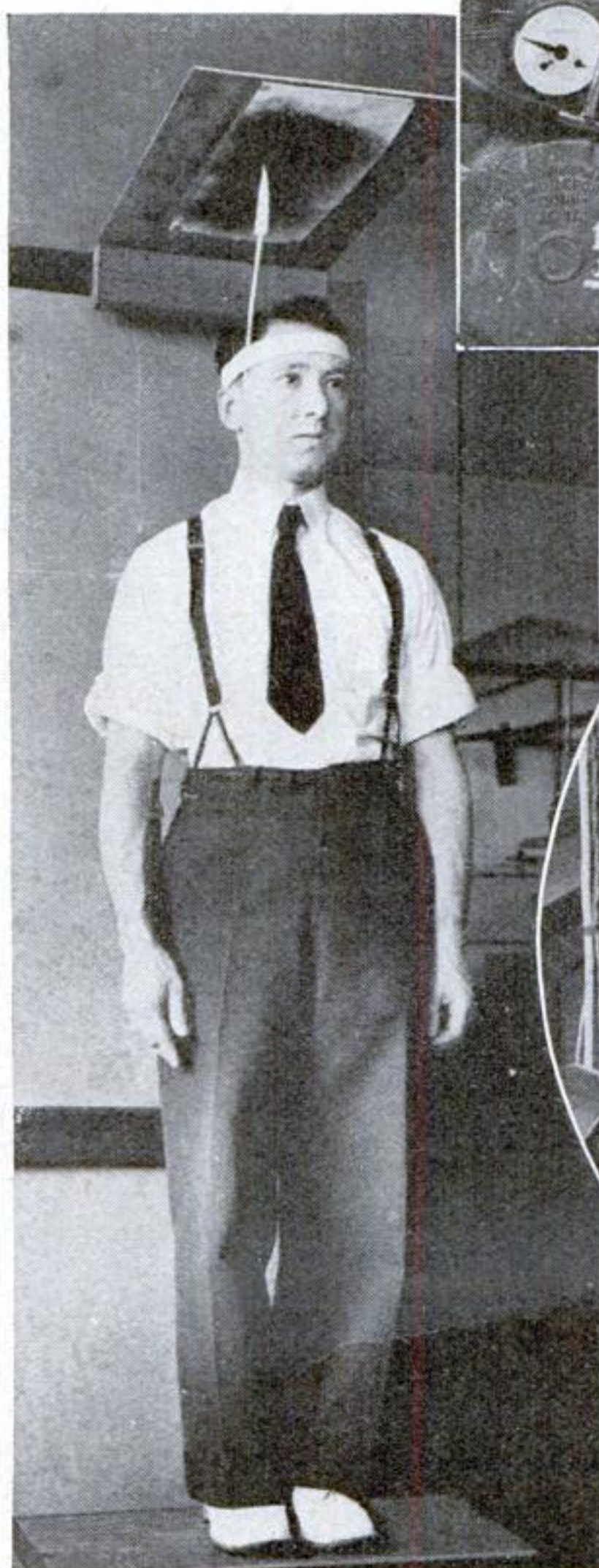
Four men were exposed for two hours to a concentration of twenty-five percent gas in air, in an air-tight room, yet they suffered no changes in appetite, vision, or other functions except a sense of mild exhilaration. Throughout the period, the four men repeatedly demonstrated their ability to stand in an absolutely upright position, by drawing a writing mechanism attached to the head back and forth upon a paper fixed to the ceiling.

"With the exception of a slight anesthetic effect in a very high concentration," Dr. Drury declared, "we may say that natural gas has no poisonous action on the human system."

In this air-tight room, four subjects were exposed to a twenty-five-percent mixture of gas in air for two hours. The mixture was controlled and tested with the apparatus at the right



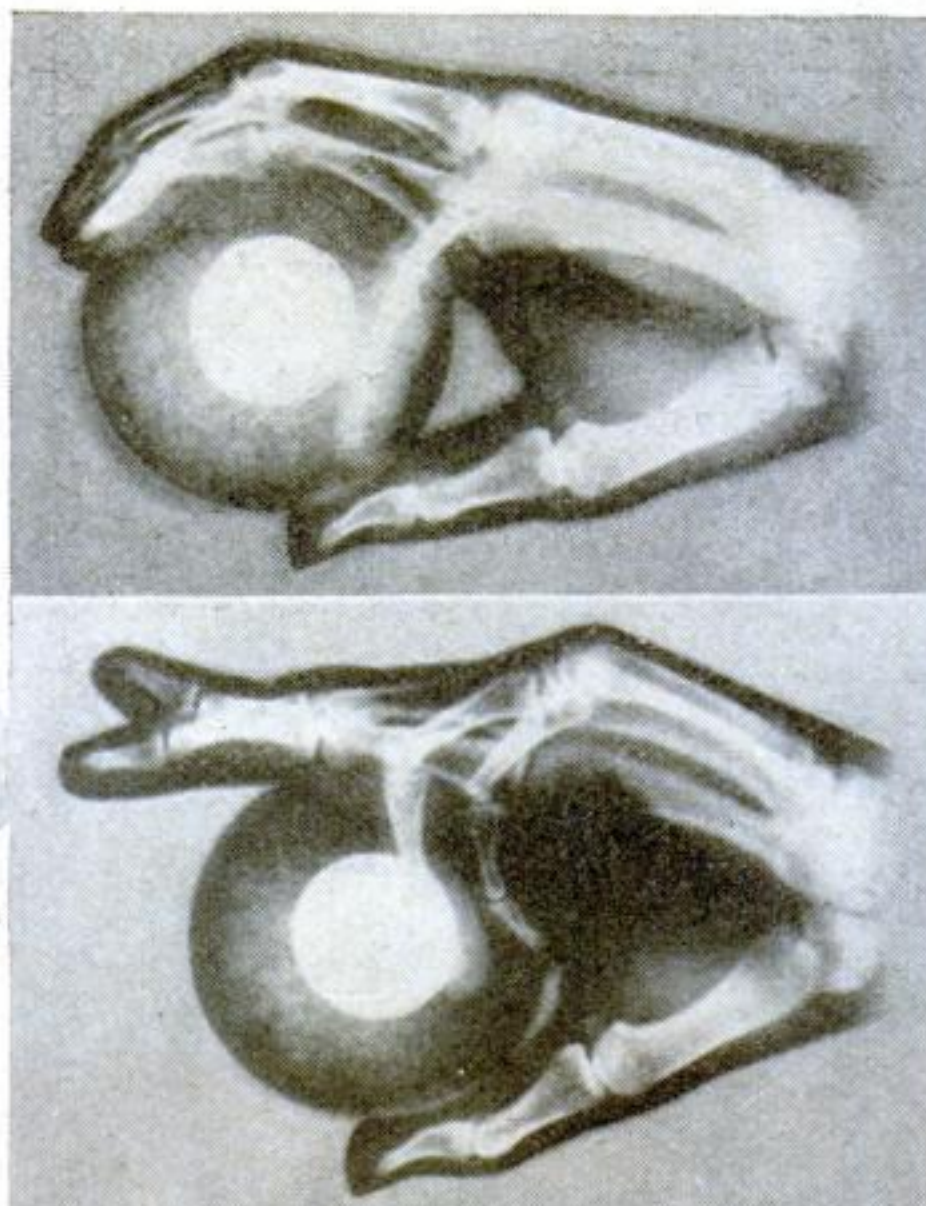
The tank in which monkeys and rats were kept during long periods to prove that they could breathe gas



A subject undergoing an electrocardiograph test after leaving the gas chamber. At the left, he is proving his ability to stand steadily by tracing a straight line on the paper



Secrets of Pitcher's Throw Revealed by X-Ray Photos



The X-ray photographs show how a baseball pitcher holds the ball for a fast throw, at top, and how he changes finger position for a deceivingly slow ball

How the finger bones of a baseball pitcher look when he is about to throw a ball is revealed by an odd series of X-ray pictures recently made. The upper photograph shows the grip of a left-hander as he is about to deliver a fast ball. The lower illustration depicts the position of the fingers when pitching a change-of-pace ball, thrown after a fast ball to fool the batter.

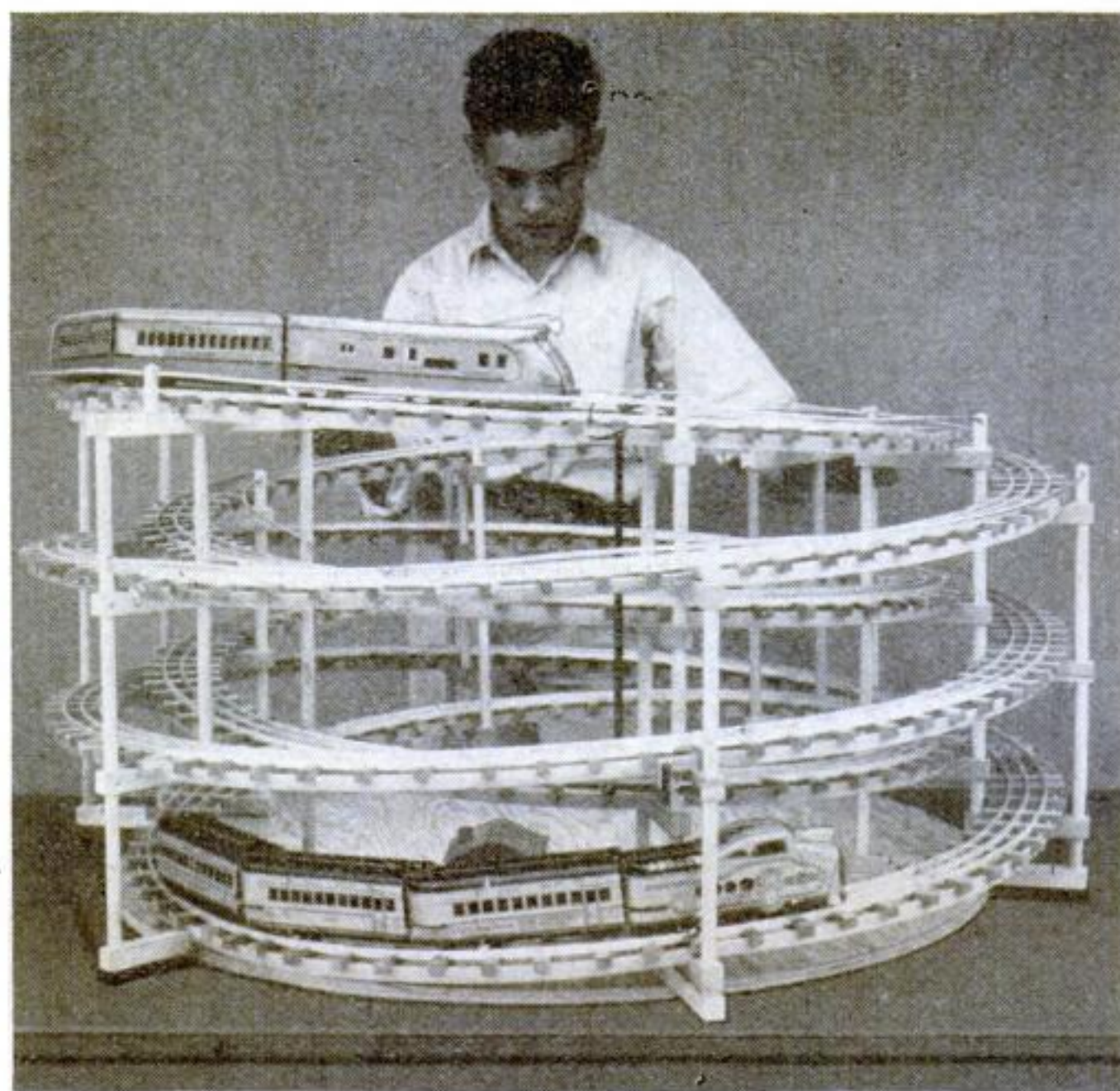
Marketing Bag Folds Into Compact Bundle

A HANDY shopping bag just marketed rolls up when not in use into a compact ball not much larger than an egg. Easily carried in a pocket or in a woman's purse, the bag is made in the form of a net, with a drawstring to close off its open end. The bag holds a good supply of groceries.



Spiral Track for Toy Trains Saves Space

SIXTY feet of O-gauge miniature-railroad track are condensed into a double spiral only forty-four inches in diameter in a novel layout recently introduced. As shown at the right, two trains run simultaneously on the continuous track, one climbing the $4\frac{1}{2}$ -percent grade as the other descends on an inner spiral. Current switches are tripped automatically by the trains so that neither will overtake the other. The supporting framework for the circular railroad line is made of wood.



One train climbs while the other descends. Control is automatic



Observers were riding in the target boat when this picture was taken, but normally it operates without a crew

Radio-Controlled Motor Boat Is Target for Bombs

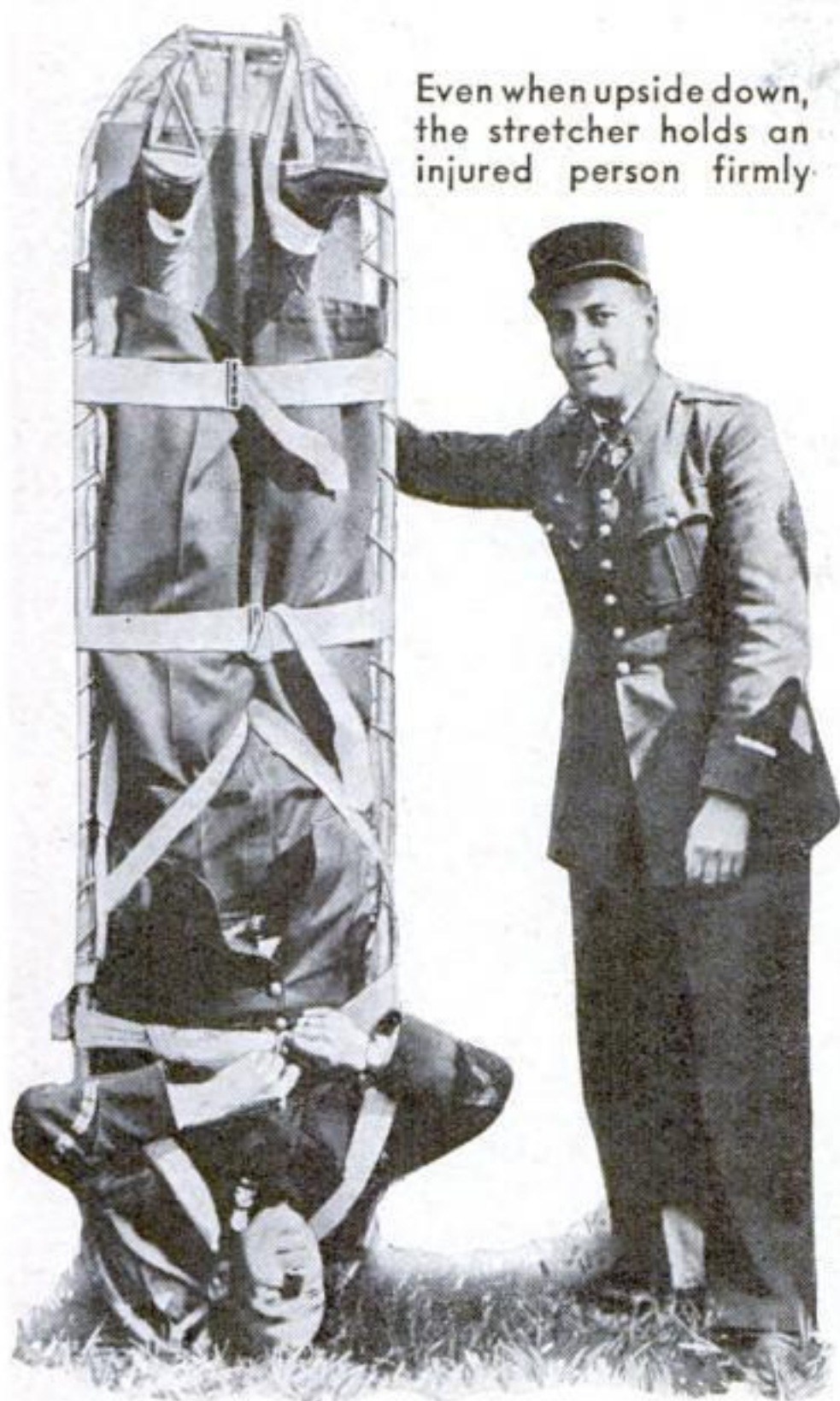
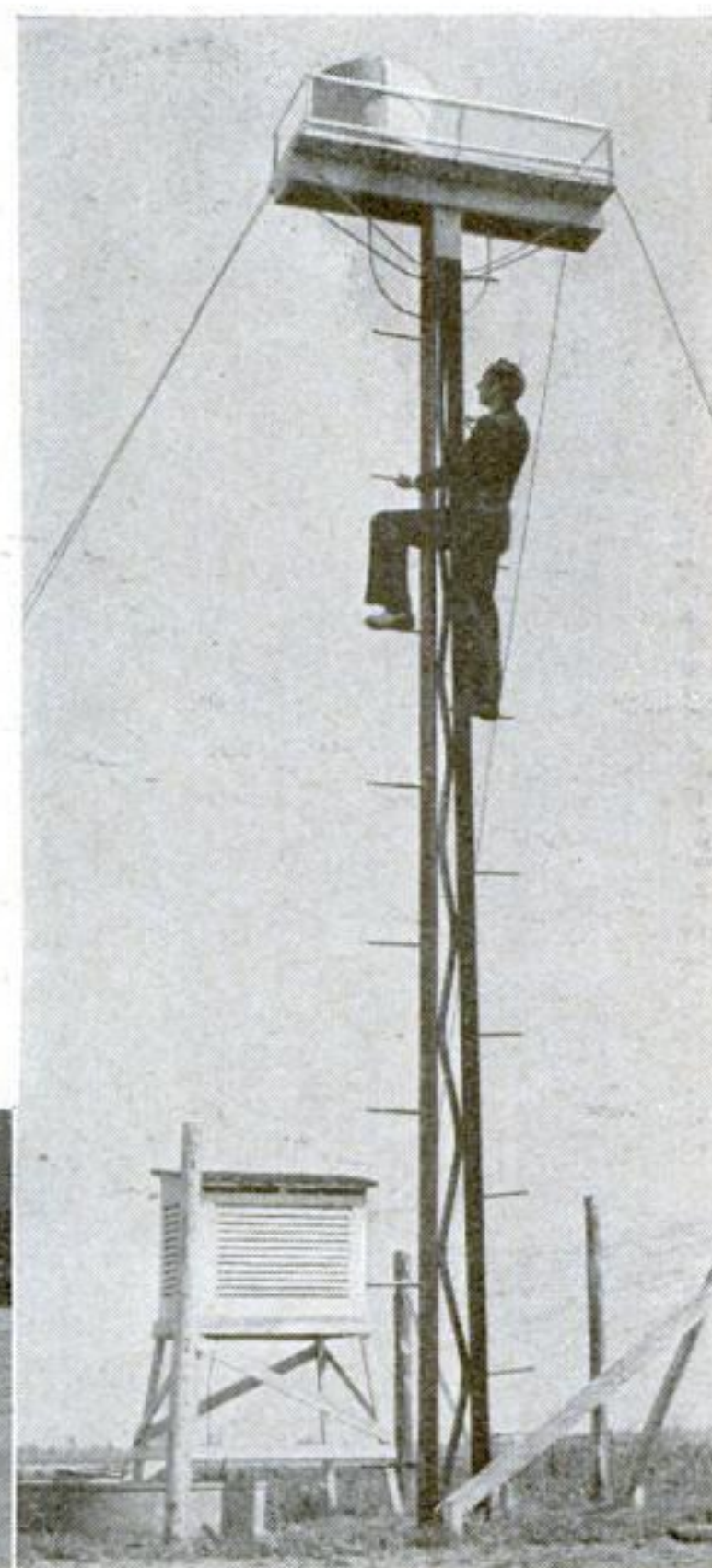
RACING at high speed, an armored target boat just completed for the British air force is controlled by radio to provide a fast-moving, shifting target for machine-gun and bombing practice. The target craft is shown on a trial run with observers riding in its normally unmanned cockpit.

High Towers Collect Dust-Storm Specimens for Study



Samples of wind-borne dust collected by the towers being compared with a map of regional soil colors. At right, the dust is being tested for its effect on seeds

TO STUDY dust storms, gauges mounted on twenty-foot platforms at an Oklahoma experiment station collect wind-blown dust specimens for laboratory analysis by scientists at the state agricultural college at Stillwater. Wall maps colored to indicate soil tints in various localities are compared with the hues of dust specimens as seen under the microscope to determine their point of origin. Chemical analysis of the tiny particles reveals the presence of noxious weed seeds, plant parasites, or infectious-disease germs, while mathematical calculations show the total amount of dust falling on an acre in a given period. The studies are made to determine how wind-blown dust may affect local agricultural conditions as well as the general public health. Bean seeds are inoculated with the dust as a final check-up.



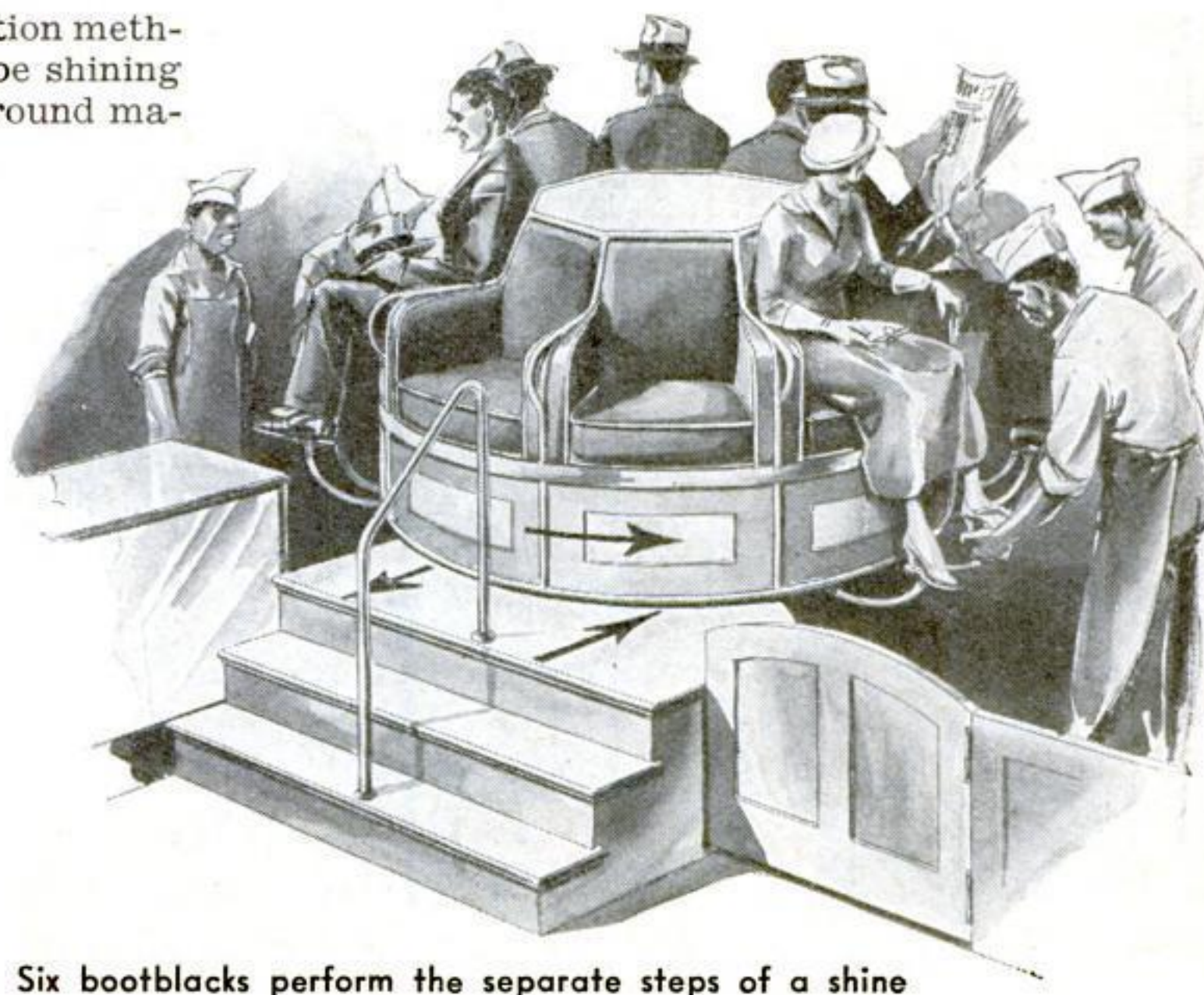
Even when upside down, the stretcher holds an injured person firmly

New Airplane Stretcher Holds Patient Securely

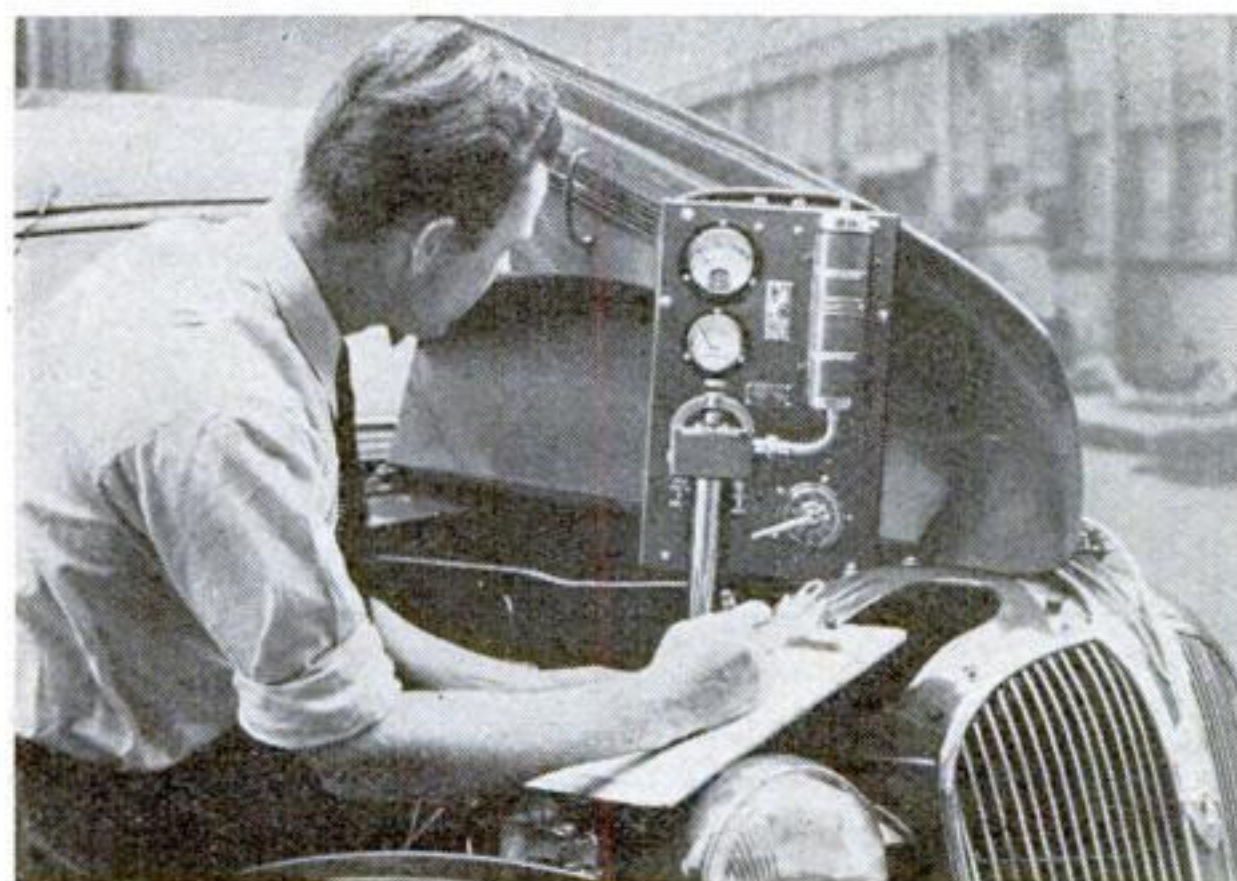
DESIGNED primarily for use in airplanes, a new hospital stretcher is equipped with straps so placed that a wounded occupant cannot accidentally fall out while a plane is banking, diving, or going through other maneuvers. The photograph above shows a French soldier, fastened into the stretcher, with his head toward the ground. The straps over his shoulders and across the insteps of his feet keep him from falling.

Shoe-Shine Stand Built Like Merry-Go-Round

HIGH-SPEED production methods are applied to shoe shining on an odd merry-go-round machine recently installed in a St. Louis, Mo., boot-black parlor. As indicated at the right, a customer takes one of the eight seats that face outward on the circular device, places his shoes on foot-rests, and is slowly turned around while six operators perform the separate tasks of cleaning, polishing, and buffing. At the end of one minute, the customer's shoes are neatly polished.



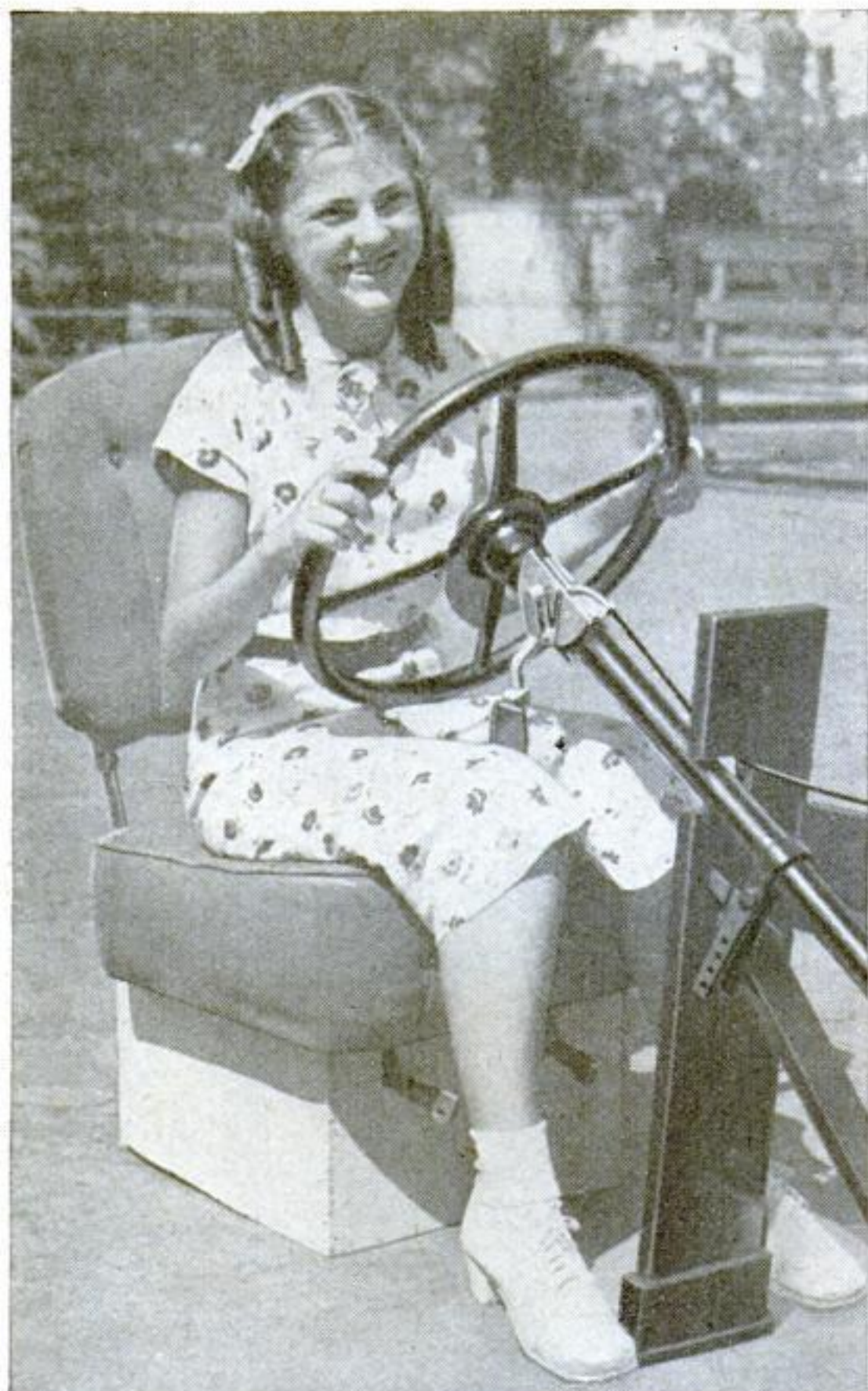
Six bootblacks perform the separate steps of a shine



Individual cylinders can be tested with this meter

Meter Tests Car's Fuel Efficiency

A NEW device for testing the combustion efficiency of automobile engines analyzes the exhaust from each motor cylinder. Attached to one cylinder at a time, the unit registers the amount of unused gas present in the exhaust. The makers claim that the apparatus is so sensitive that it will detect as little as one part of unused fuel in a million parts of a cylinder's exhaust fumes.



Knee-Operated Throttle Rests Driver's Foot

TO REST an autoist's right foot on long drives, a new accelerator lever is operated by pressure of the knee. Shown mounted in a dummy car above, the device clamps to the steering column and can be folded out of the way when not in use. It is said not to interfere with the operation of the regular accelerator pedal.

Life Belt Warms Wearer

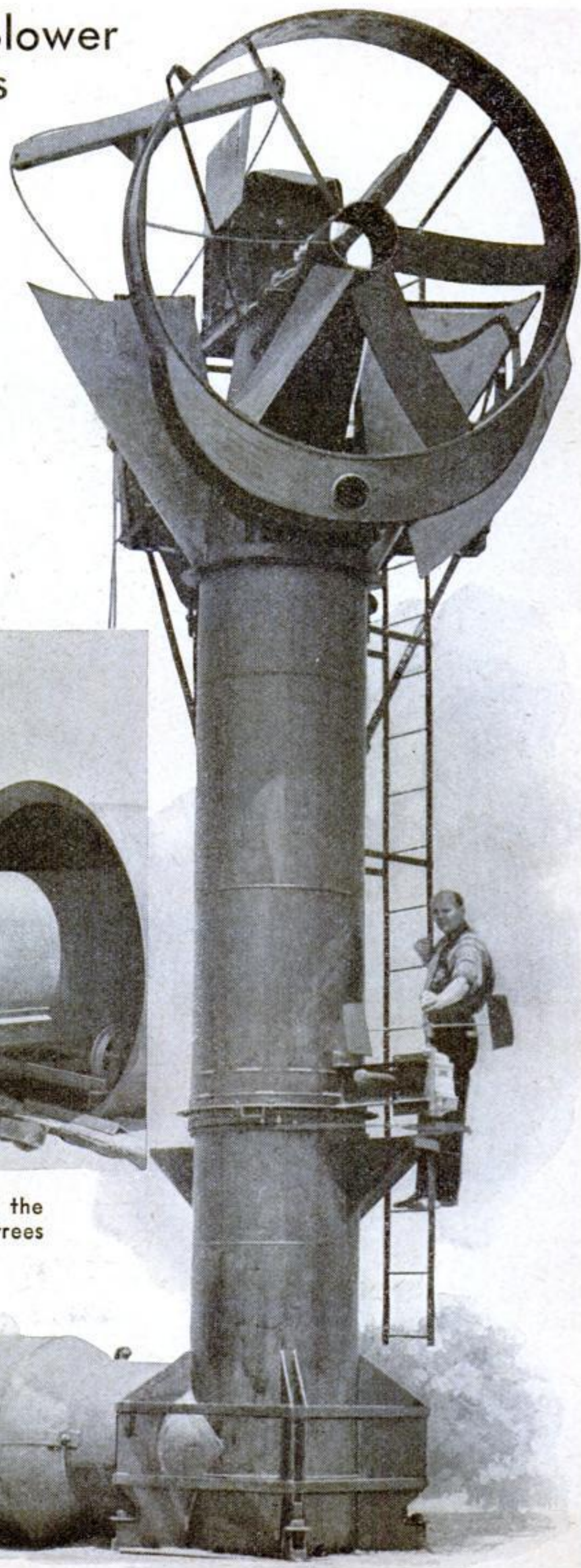
A NEW life belt not only keeps shipwreck victims afloat, but provides food and water in moistureproof packages, while chemicals generate heat, when moistened, to protect the wearer from the cold. To aid rescue, the belt is luminous and carries mirrors that reflect beams from rescuing searchlights.

Giant Warm-Air Blower Guards Fruit Trees

BLANKETING citrous trees with a layer of warm air on cool nights, a giant wind machine developed by a California inventor resembles a huge iron windmill. Air is heated in a horizontal, boiler-like oven on the ground, and sucked upward through a vertical pipe by an airplane propeller. Vanes mounted in front of the propeller can be adjusted to direct the air blast in any desired direction, enabling a single machine to protect a ten-acre fruit grove from frost.

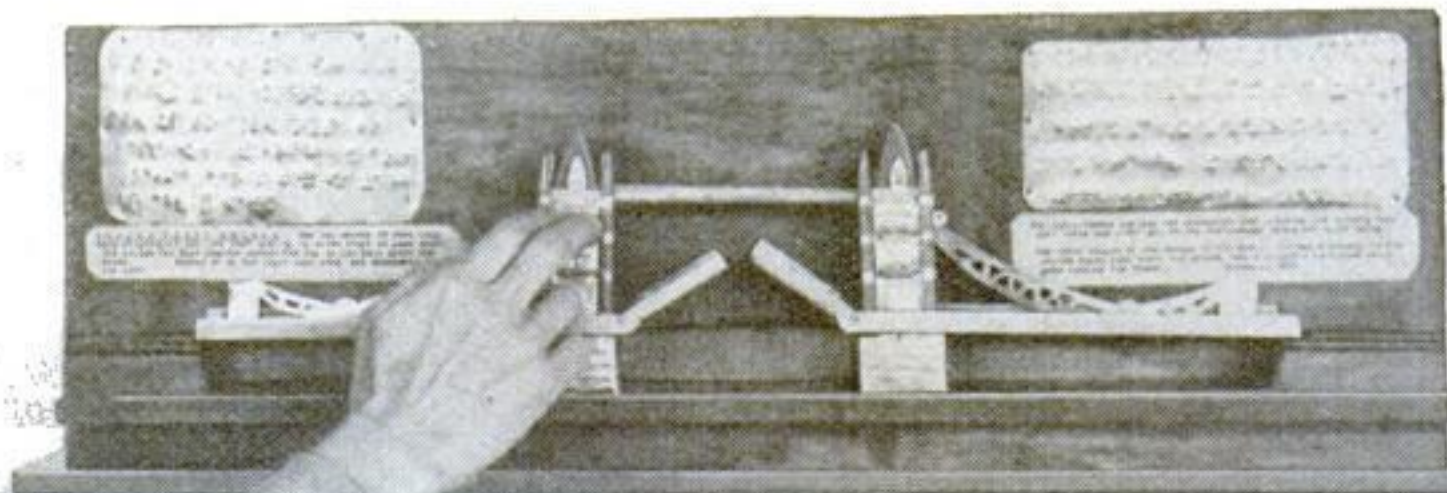


The wind machine, its air intake, and the propeller that blows warm air over trees

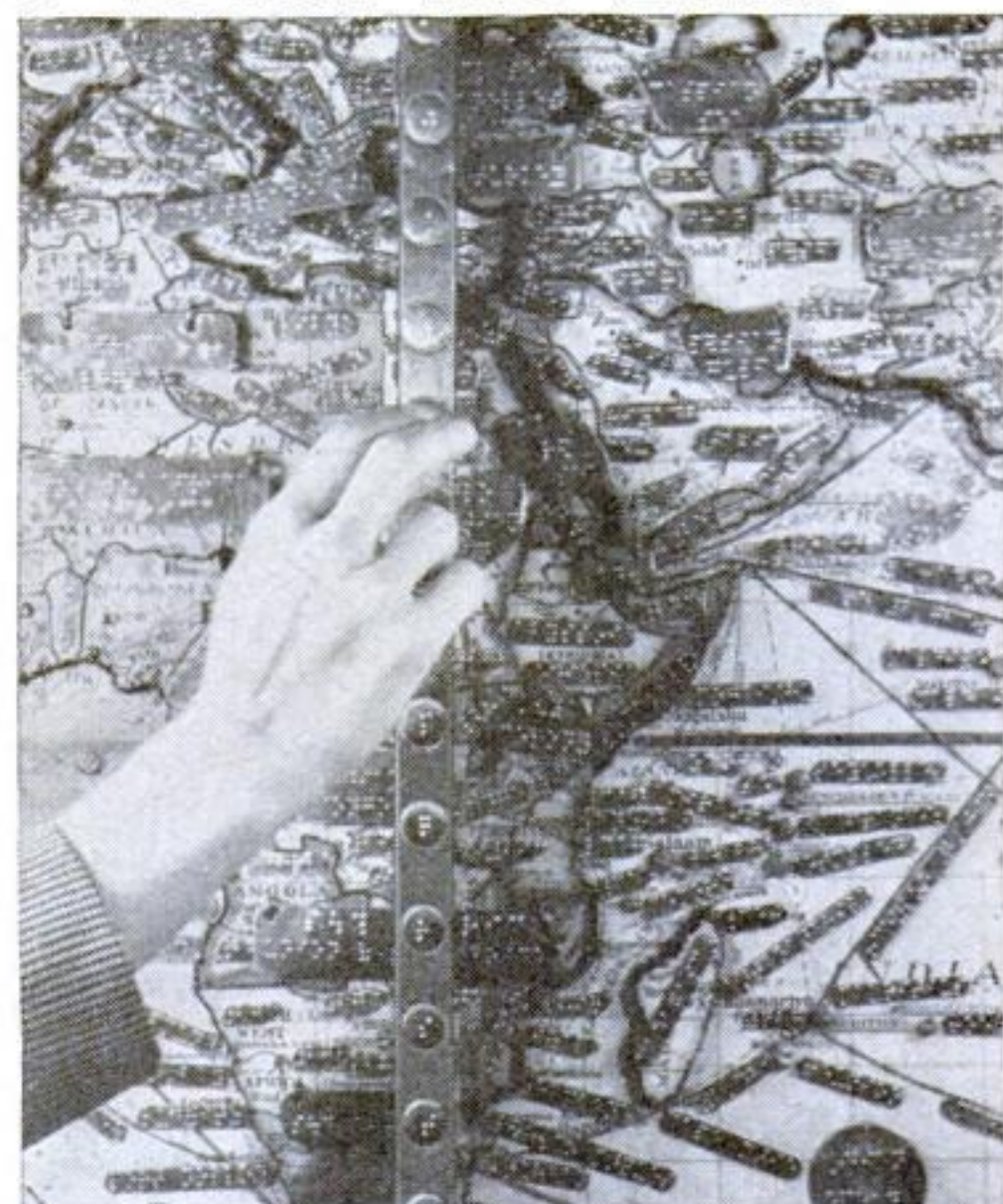


Relief Maps and Models Used To Teach the Blind

BUILDING relief maps and models especially for the blind is the odd hobby of a Brisbane, Australia, business man. The maps are arranged so that each geographical outline can be traced with the fingers, while place names are identified both by typewritten labels and aluminum tabs embossed with raised letters in Braille. Models of famous ships and structures are made to be examined by touch.



Studying a model of a bridge by touch. A sliding scale enables blind readers to locate places on the relief map at the right

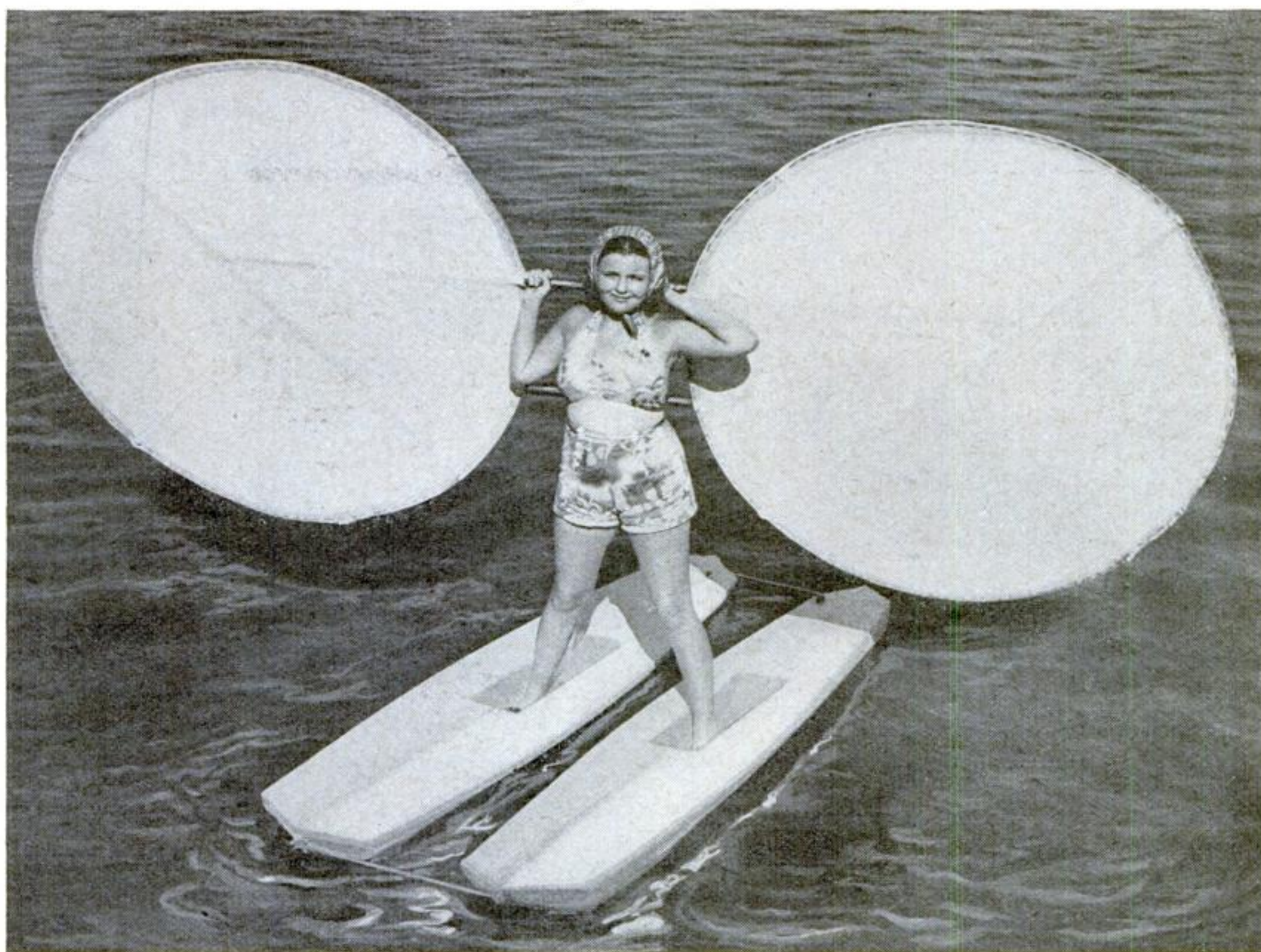


Vacuum Device Drains Auto Oil

MOTORISTS who equip their automobiles with a new accessory can drain crankcase oil without crawling underneath. A pipe, attached to the crankcase and connected to the intake manifold is fitted with a valve placed under the engine hood. When the container is pressed against the valve, the vacuum created by the motor sucks the oil up into the bottle.



Pressing the bottle neck against a valve drains out crankcase oil



Double Sails Propel Bather on Water Skis

OVAL sails fastened to rods that are held at shoulder level propel the wearer of new water skis. The novel marine footgear, worn during a recent California water carnival, are made of a buoyant frame-

work, covered with canvas to form water-tight compartments. Tied at front and back, they enable the wearer to skim along the surface. Changing the angle of the sails permits traveling across the wind.

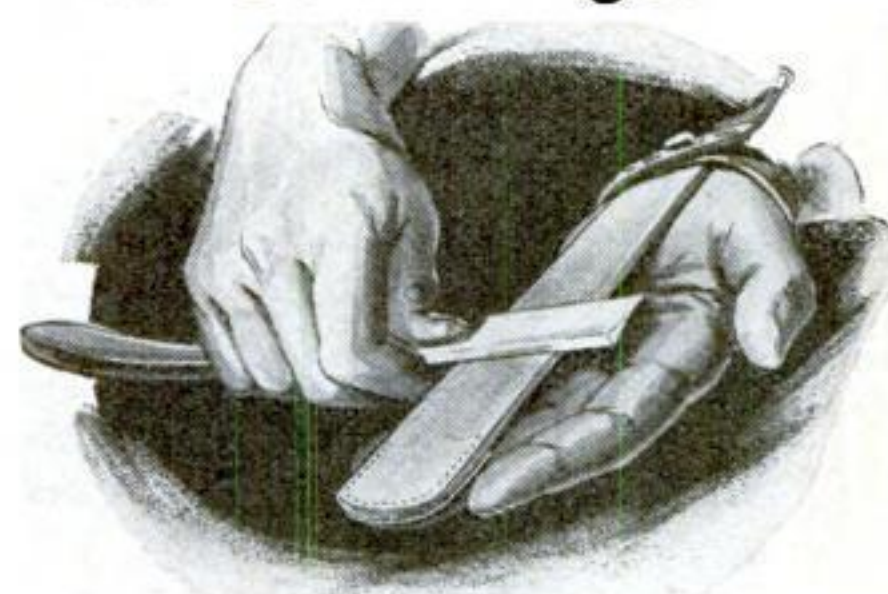
New Office Duplicator Needs No Stencils

WITHOUT using stencils, copies of printed, hand-written, or typed material can be made quickly with a new portable electric duplicator. Laid on a plate-glass surface at the top of the apparatus, the original to be copied is covered with a sheet of sensitized photographic paper. When the lid is closed and a switch pressed, lights transfer the image of the original to the paper, which then is developed under ordinary light without any need for a darkroom.

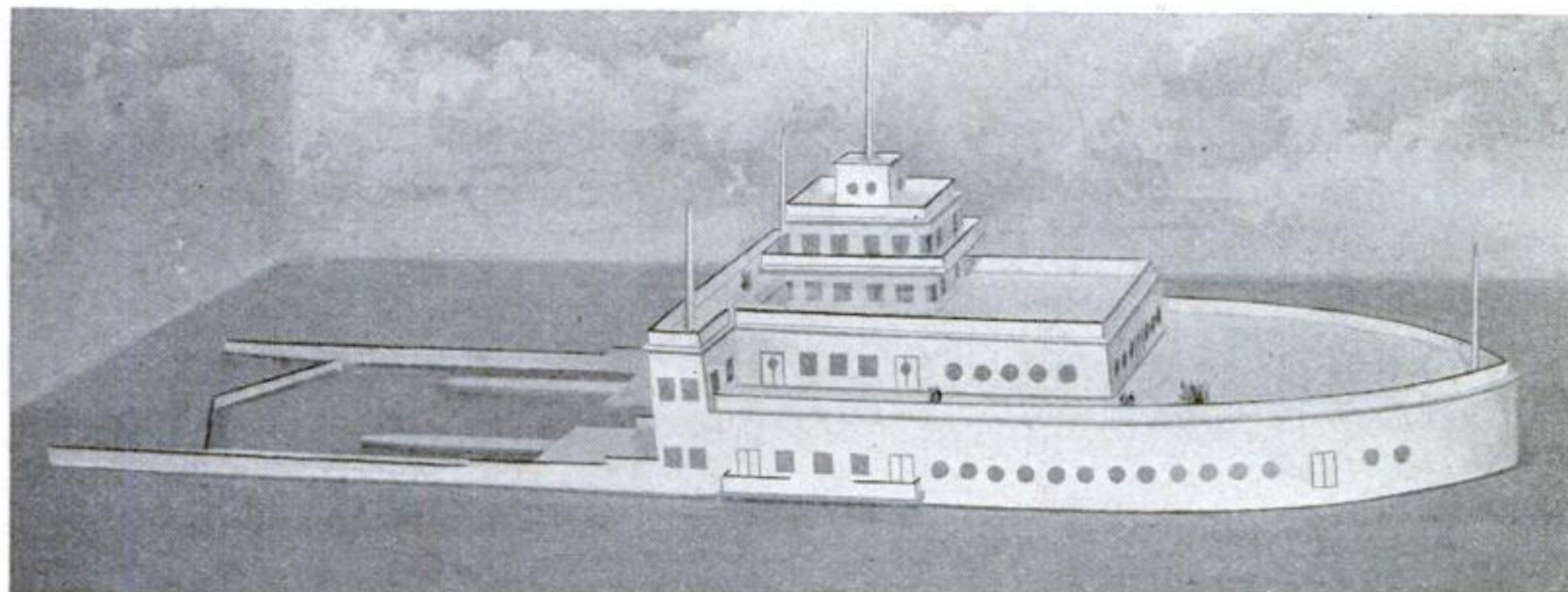


No darkroom is required to use this new portable photographic duplicating device

Odd Razor Sharpener Fits Over Finger



A NOVEL, glovelike razor strop just invented is worn on the third finger of the hand. Strapped at one end to the wrist, the sharpener is tilted to provide the correct sharpening angle by twisting the hand as the razor is stropped.



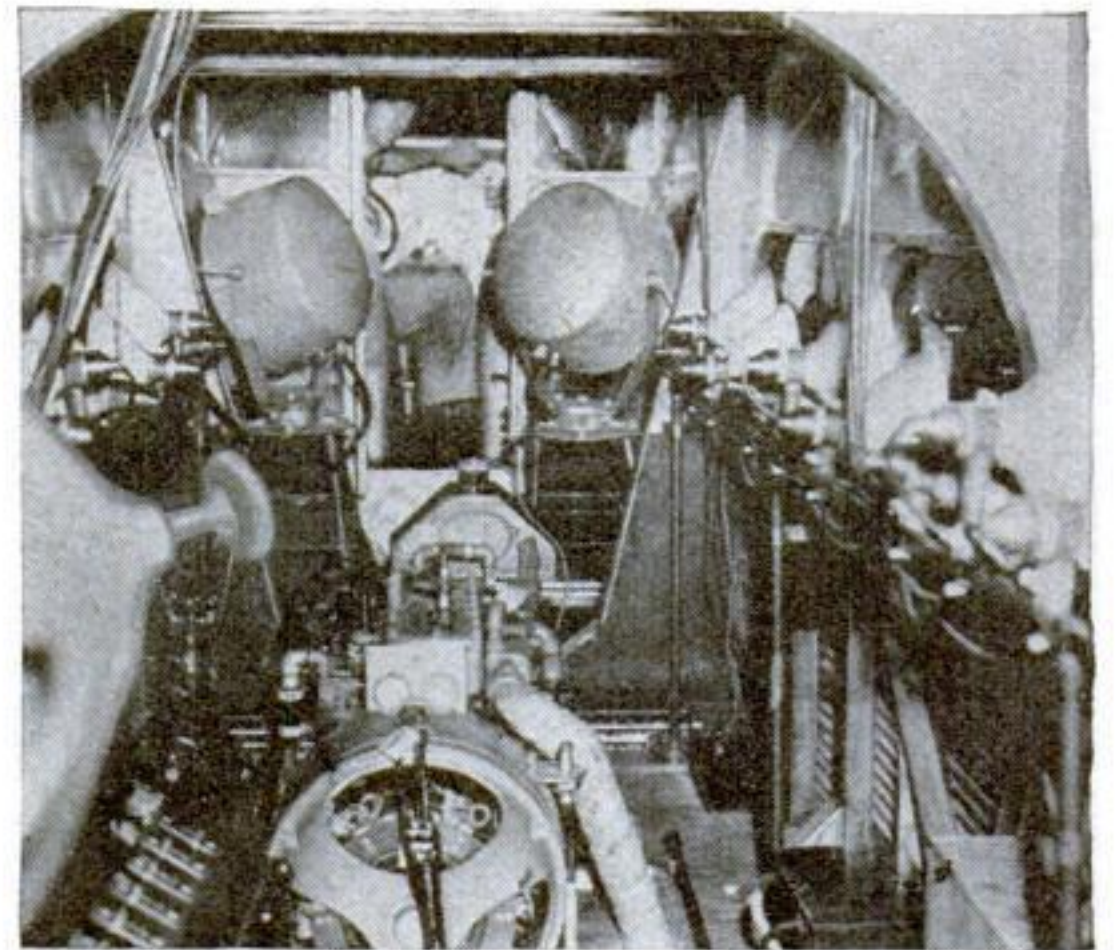
The basin at the stern is a landing place for seaplanes, while hotel accommodations are forward

Floating Air Base Has Repair Basin

A GIANT, mobile seaplane base recently proposed provides a protected basin 150 feet long and eighty feet wide as a landing harbor for transoceanic planes. As shown in a model just completed, the floating base has a commodious terminal at its forward end, while a water gate at the open end of the basin would permit the latter to be emptied for use as a repair drydock.

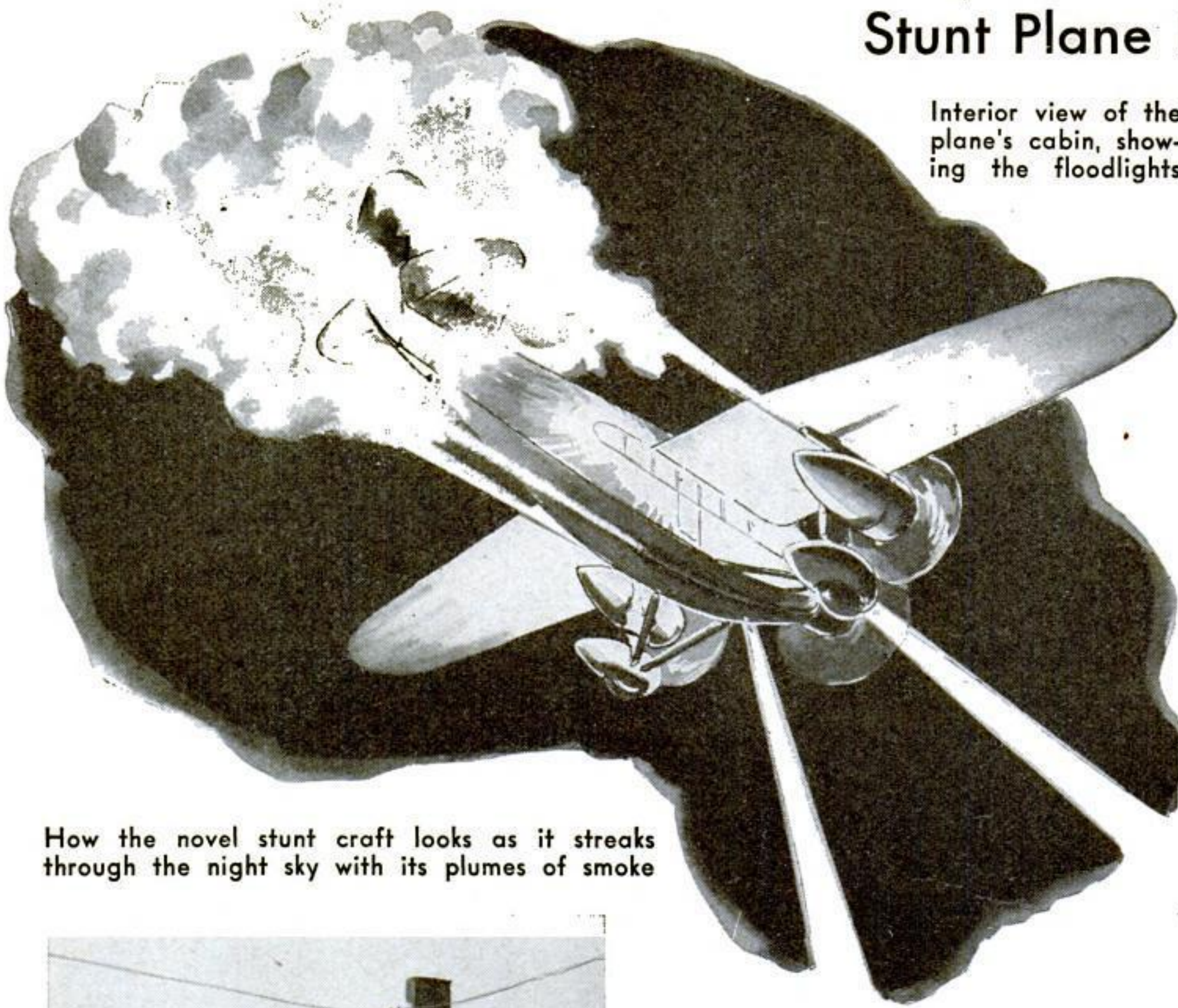
Stunt Plane Resembles Fiery Comet

Interior view of the plane's cabin, showing the floodlights



ROARING through the night sky like a flaming comet, a novel airplane operated by a Missouri pilot is equipped with a gasoline-driven generator that supplies current to a maze of floodlights and electric bulbs mounted in the fuselage. Used as a stunt plane at fairs, the machine has three powerful searchlights, and rows of lamps that illuminate smoke streams trailing from its three motors.

How the novel stunt craft looks as it streaks through the night sky with its plumes of smoke



Titanic Teeth Teach Toothbrush Technique

A GIANT set of false teeth set up in an Austrian health clinic is used as a demonstration model to explain the correct method of brushing the teeth. As shown in the photograph at the right, a clinic instructor manipulates an oversize toothbrush on the surfaces of the huge model while a group of school children follow her motions in scrubbing their own teeth.



A teacher demonstrating care of the teeth with an oversize model

Novel Electric Scarecrows Ring Gongs To Shoo Birds

ELECTRIC gongs served as mechanical scarecrows in recent tests made by a German biological institute. Housed in wooden boxes attached to poles set in the ground, the gongs were wired to a control center where relays automatically set off the alarm once every three minutes to frighten away bird pests. The photograph shows an installation set up in a wheat field.

Spade Has Triple Points

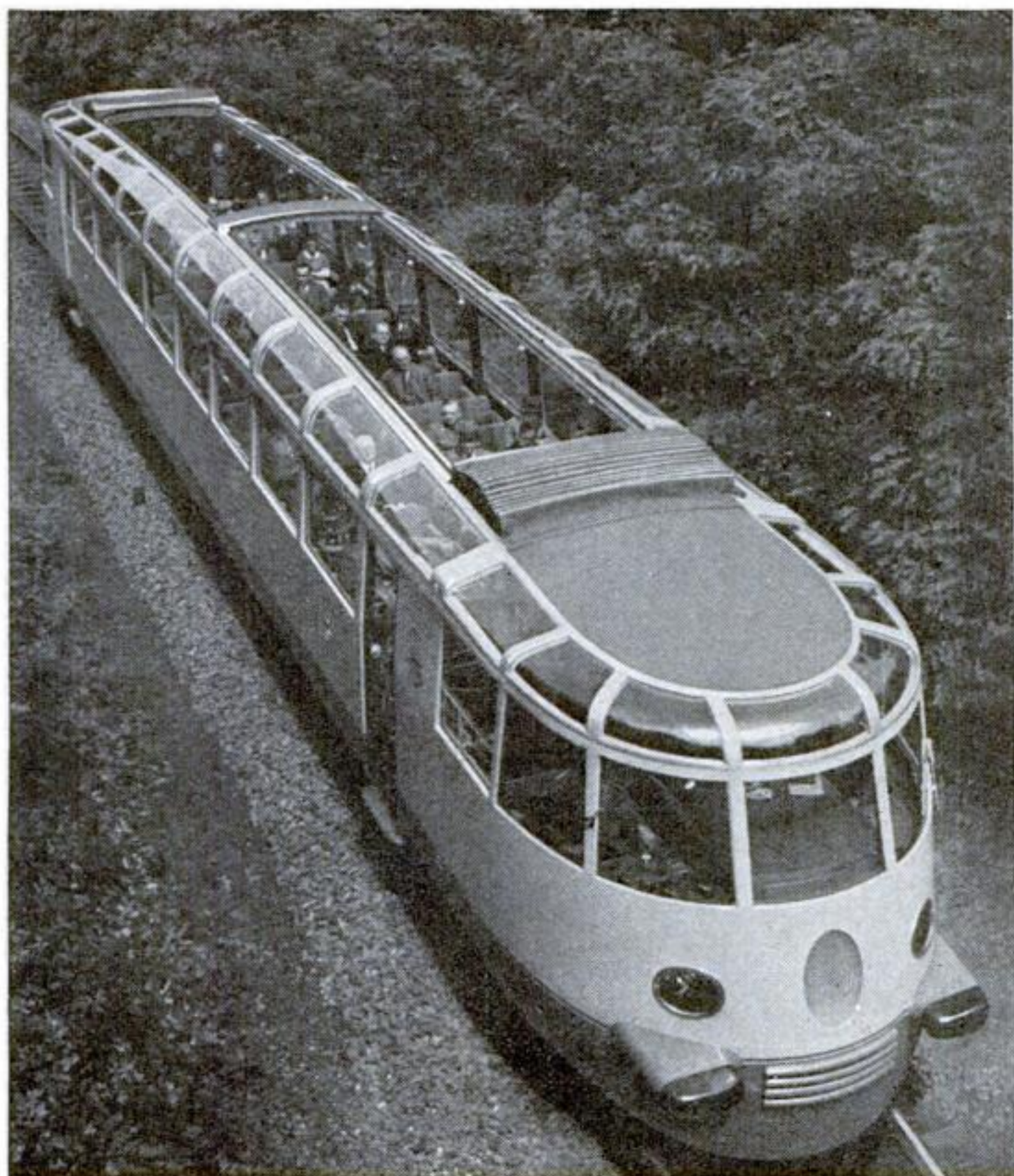
TIPPED with three pronglike points, a new German spade enters hard earth easily. Called a "leveling spade," the tool is said to save forty percent of the energy expended in digging.

Vault Holds Articles of Present-Day Life



Some of the everyday objects to be preserved for future historians

CHEWING GUM, symphony records, newspapers, a dictionary, and a bottle of a popular soft drink are some of the items placed in a history vault that is not to be opened for 6,177 years. Objects and records which will tell future generations what present-day life was like were collected by a southern college president and stored in a subterranean crypt designed to be both fireproof and earthquakeproof.



Sight-Seeing Coach Uses Railroad

EQUIPPED with a roof that slides forward and folds up like an accordion into a compact unit, a new railway coach has just been placed in service on a German railroad for use as a sight-seeing car in the picturesque mountain district bordering on Belgium. Driven by a built-in power unit, the coach has open sides to give passengers a full view of the surrounding forest scenery. The track over which the coach runs was used for troop trains during the World War.

Line-Bucker Trains on Butterflies

CHASING butterflies is better exercise than hauling ice or chopping wood to put football players into trim for the fall season, according to Bailey Williams, captain of the team at Davidson College, Davidson, N.C. Williams says that the sport hardens his muscles and lengthens his wind.

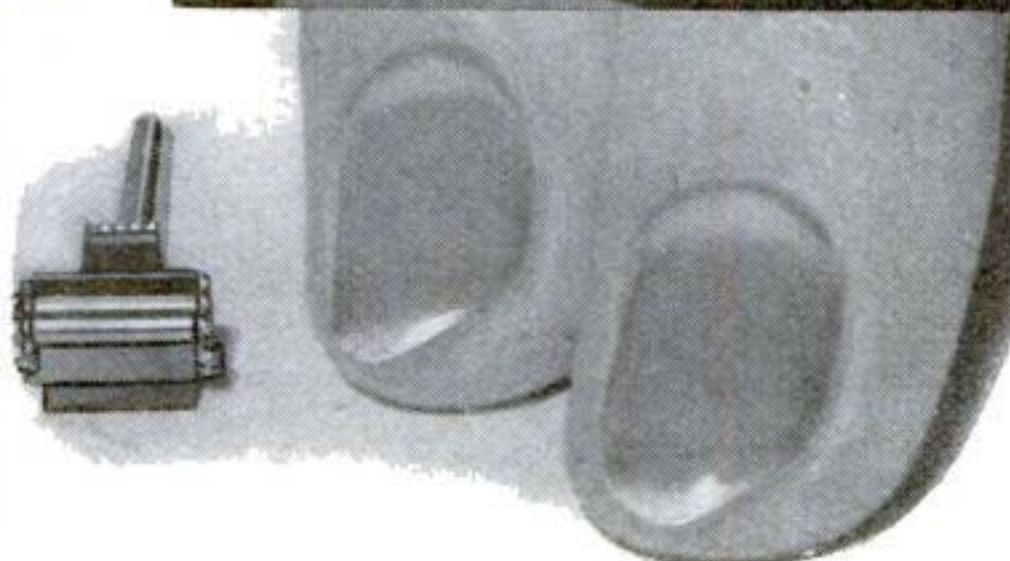


Bailey Williams, football star, tackling a butterfly

Big Collection of Tiny Objects Shown



The midget cash register at the left actually works. Below are a miniature electric stove and a finger-nail-size safety razor

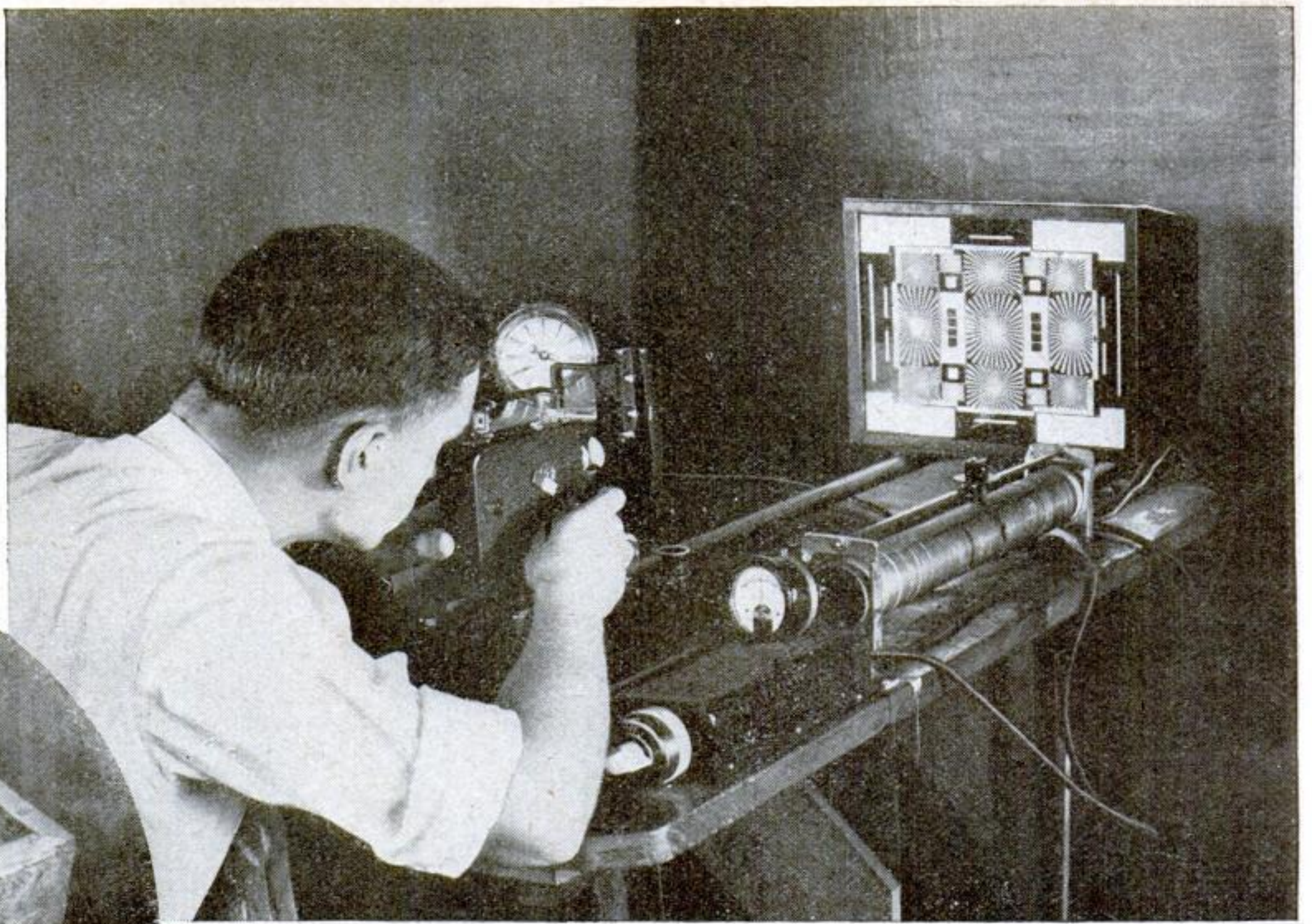
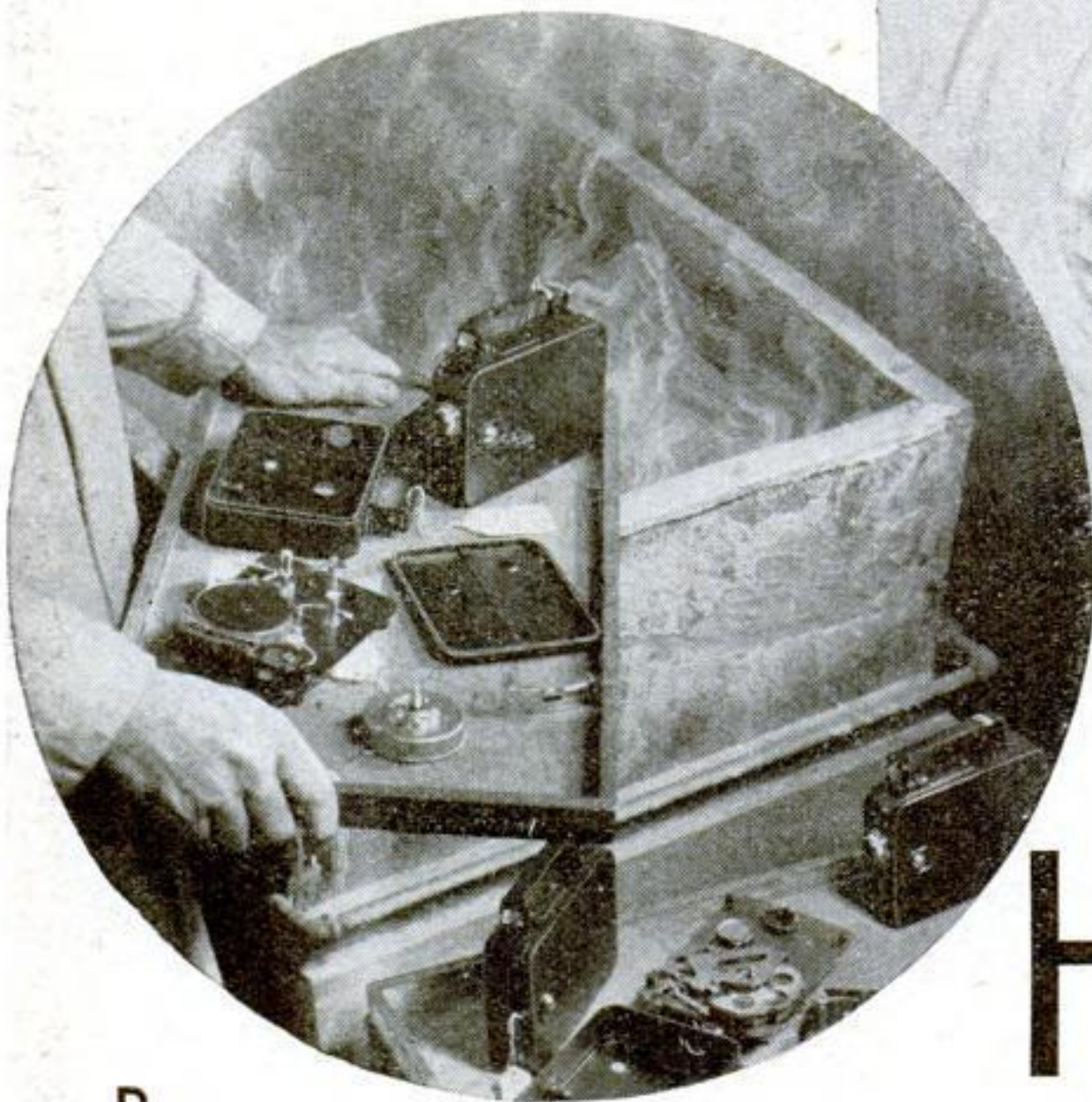


WHAT is called the world's largest collection of the smallest models and curiosities in existence is now being exhibited by its owner, Jules Charbneau of Seattle, Wash. Included among the 25,000 separate items in the collection are a miniature cash register that actually works, a safety razor no larger than a finger nail, and a working model of an electric range that is dwarfed by comparison with a human hand. Other items which draw attention include a diminutive piano whose keys are so small that they have to be played with a toothpick, and a tiny camel which can easily pass through the eye of a needle.



Car's Luggage Carrier Serves as Animal Cage

BY FITTING the luggage-compartment door with wire screening, a humane-society representative adapted his car for carrying dogs and other animals to shelter. The improvised cage is seen in the photograph above, together with the hoops, ropes, and long poles used to snare stray or mad dogs, and to rescue cats from trees and other dangerous spots.



An inspector photographing a test chart with an amateur motion-picture camera to check the quality of its lens. At the left, instruments are being put into a box where they are subjected to a salt spray 1,000 times as concentrated as any encountered at the seashore, to try the effect on the mechanisms

How Tough Is

By
WALTER E. BURTON

IN A little room at Rochester, N. Y., several cubic feet of the Sahara Desert stand side by side with similar chunks of the Arctic regions and the steaming tropics. And in these bits of transplanted climate cameras, parts of cameras, and photographic accessories undergo a scientific "third degree" that reveals whether they can "take it" in actual service. There are cameras covered with thick, year-old growths of the mold that makes a tropical photographer's life miserable; cameras so hot and dry that they seem almost to cry out with thirst, and others so cold that they drip with condensed moisture the instant they are brought into ordinary room conditions. These are some of the torture-chamber methods employed to reveal possible weaknesses that might develop under extreme conditions of service in any part of the world.

Garson Meyer, chief, and Joseph M. Keating, assistant chief of the chemical laboratory of the Eastman Kodak Company camera works, carry out these and other severe tests in order to keep a check on camera production, and to head off troubles that might plague camera users. Also, the tests serve to show how cameras can be improved.

The transplanted-climate room of the laboratory contains three large, insulated cabinets with air-tight doors. They are made like refrigerators, but inside they are vastly different from the

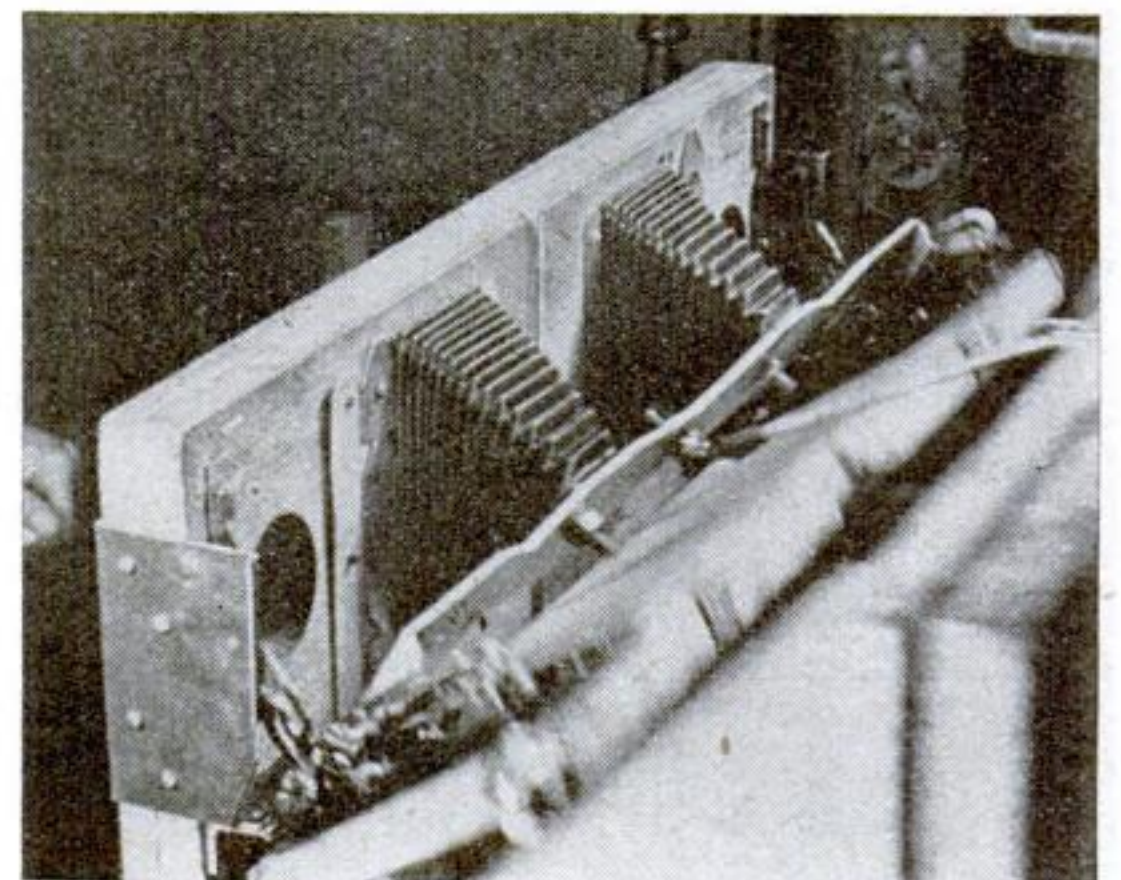
typical household cold chest. One of them is the humidity-test chamber that represents the tropics. Its temperature is kept at ninety degrees Fahrenheit, and its relative humidity at ninety-five. Stick your hand inside this artificial bit of the tropics, and your skin feels clammy. Here films, cameras, leather covering materials, and other parts are tested to determine how they will withstand tropical climates. The action of mold, one of the worst enemies of a camera in hot countries, is studied. Such mold seems to feed on the glue that holds the leather covering in place, as well as on the leather itself.

The "Sahara Desert" is a chamber in which a temperature of 120 degrees Fahrenheit and a relative humidity of less than twenty are maintained always. Cameras must prove their ability to withstand this hot, dry condition for long periods. The polar regions are simulated in a refrigerator where the temperature remains at ten degrees below zero. Shutters, folding-camera mechanisms, and other parts must function perfectly in such cold. Some of the special equipment used by Admiral Byrd during his last polar expedition was tested at twenty-eight degrees below zero in this chamber.

Salt spray of the kind encountered at the seashore is a common enemy of most metal mechanisms. So the cameras at Rochester must be able to undergo concentrated salt baths without damage before they are con-

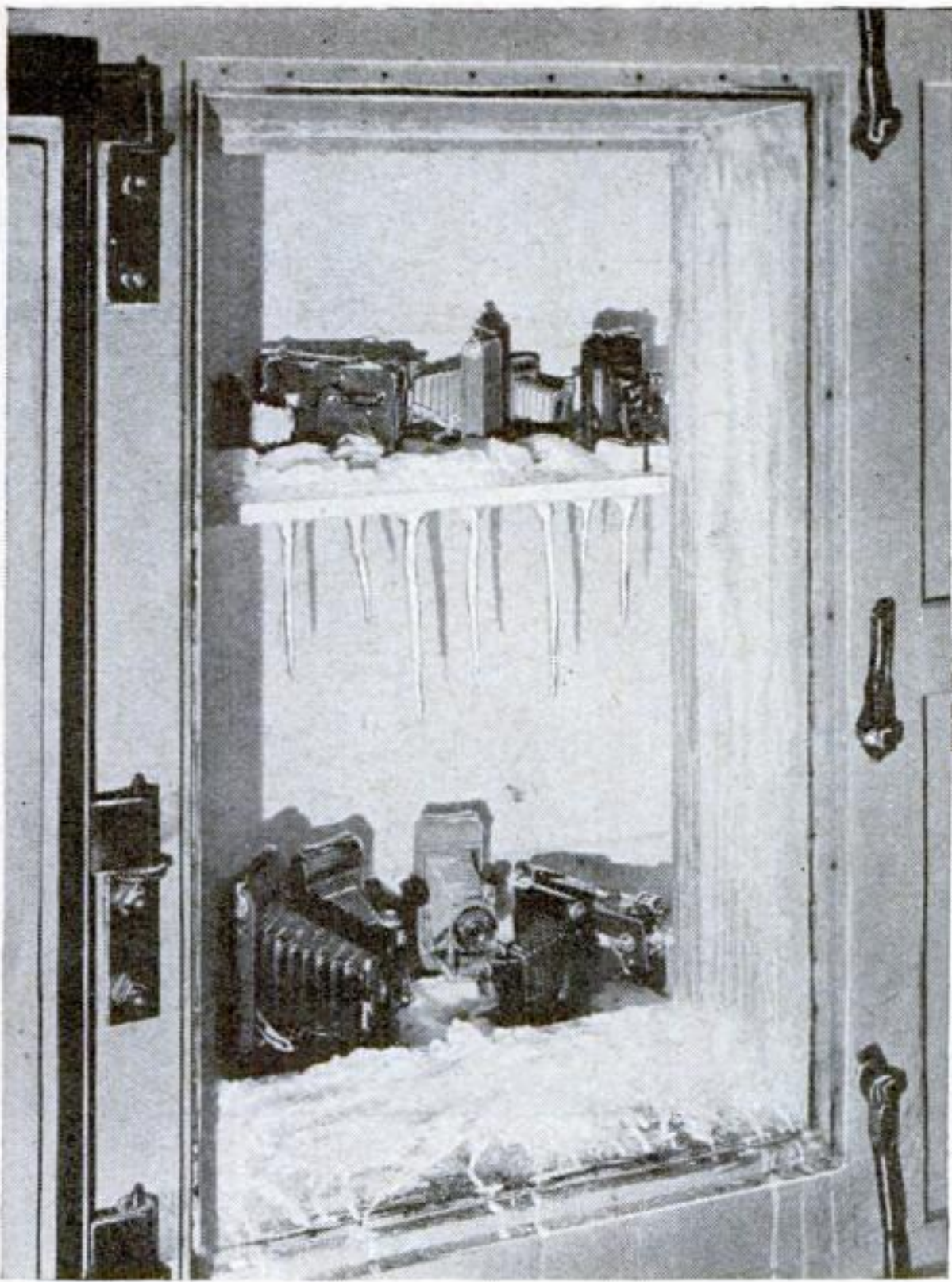
sidered fit for seaside snaphooting. A twenty-percent salt solution is atomized into the air of a closed box containing the articles to be tested. This concentration of salt is 1,000 times the maximum saltiness of the Atlantic seacoast during a severe storm. Camera parts that might be attacked by salt are made of corrosion-resisting materials or protected by durable coats of lacquer. Even the metal under the leather covering is finished to protect it from the corrosive action of salt air near the ocean.

To make certain that screws and rivets will remain in place, representative cameras taken from the production lines are given shimmy tests—are jiggled mechanically in a deliberate effort to dislodge fastenings. If that

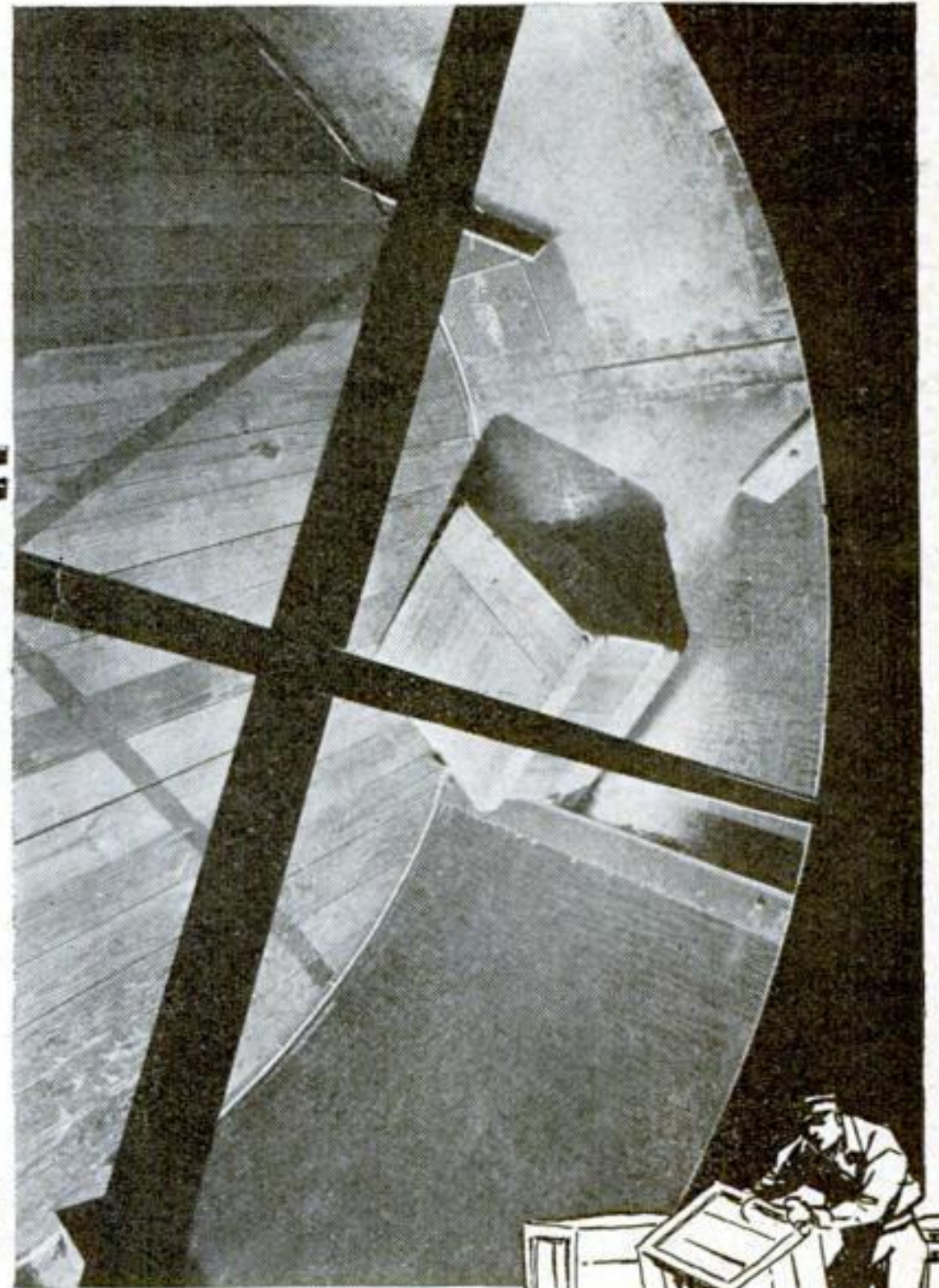


Weaknesses in bellows are revealed by this machine, which folds and unfolds them thousands of times

FREEZING IN POLAR TEMPERATURES, OR SWELTERING IN THE WARMTH OF THE TROPICS, PHOTOGRAPHIC EQUIPMENT GETS THE THIRD DEGREE IN AN ODD FACTORY LABORATORY



In this insulated cabinet, cameras are kept at a temperature of ten degrees below zero. Their delicate parts must operate smoothly under simulated arctic conditions



The tumbling machine, in which packing cases containing cameras are given rougher handling than they ever would get in shipment

Your Camera?

doesn't budge the rivets, the cameras are packed in boxes and given a ride in the tumbling machine. This device, essentially a revolving drum with steel projections on the inner surface, causes the boxes to drop repeatedly, several feet each time. This test is a hundred times more severe than any treatment a freight handler might give the boxed cameras. It shows up weaknesses in both camera and container. From experience, the camera builders know how much battering a consignment of their products takes in transit, and they have found how many minutes in the tumbling wheel are equivalent to trips of different length. All types of cameras to be shipped abroad are given tumbling tests equivalent at least to a trip around the world.

Collapsible bellows, which formerly were made of thin sheepskin, now are built up of a specially prepared synthetic cloth. Normally, a modern bellows of this construction will wear as long as the rest of the camera. To make absolutely certain that it will, the chemical laboratory carries on a series of tests in a machine that circulates air at 140 degrees over the bellows. Eight days of this are equivalent to a full year of normal use. This machine and other equipment serve to indicate the uniform quality built into bellows. Special machines fold and unfold sample bellows thousands of times, to test their durability.

A half dozen men are kept busy outdoors, testing cameras by taking pictures with them exactly as an amateur would. There is one view of Rochester, showing several factory chimneys, buildings with letters painted on them, and other details that reveal by their sharpness in the photograph whether the camera is working properly. This scene is one of the most photographed spots on earth; a picture is taken of it on an average of once every three minutes—a total of 30,000 shots a year.

When a camera

has been assembled, inspectors check its lens by focusing on a fine-linked chain placed at a distance of twenty-five feet, and examining the image with the aid of a microscope. Every motion-picture camera is checked by actually photographing a "pie-chart" test card. This card is marked with queer-looking designs that reveal the quality of the lens when the photographic reproduction is compared with the original card.

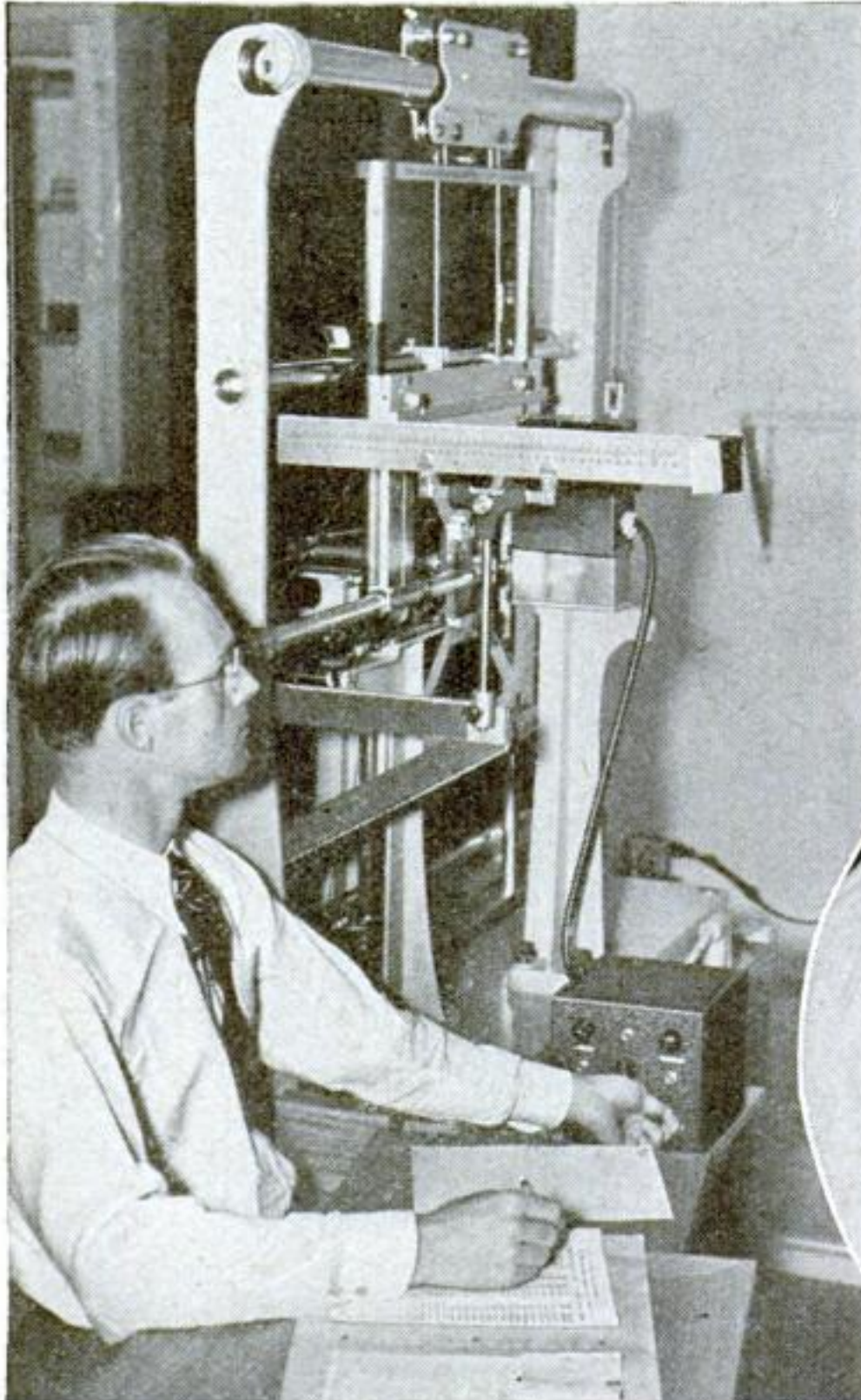
These tests, although performed largely to preserve uniformity of production and to reveal possible ways of making improvements, have turned up some facts that emphasize how the camera owner can get better service from his instrument. Although a well-made camera will withstand tropical heat and humidity, it is unreasonable to expect it to come unscathed through a ducking in the ocean or a lake. After such a bath, the camera should be returned to the factory for overhauling. Likewise, although the camera will operate in severe cold, it might not do so after a wetting with snow. The glue that holds the covering in place is treated to resist fungous growth, but cameras used in the tropics should be watched carefully for the presence of moldy spots (mildew). Keeping them in a well-ventilated place rather than in a tightly closed case is one way of preventing this growth, and this will add to the life of your camera.



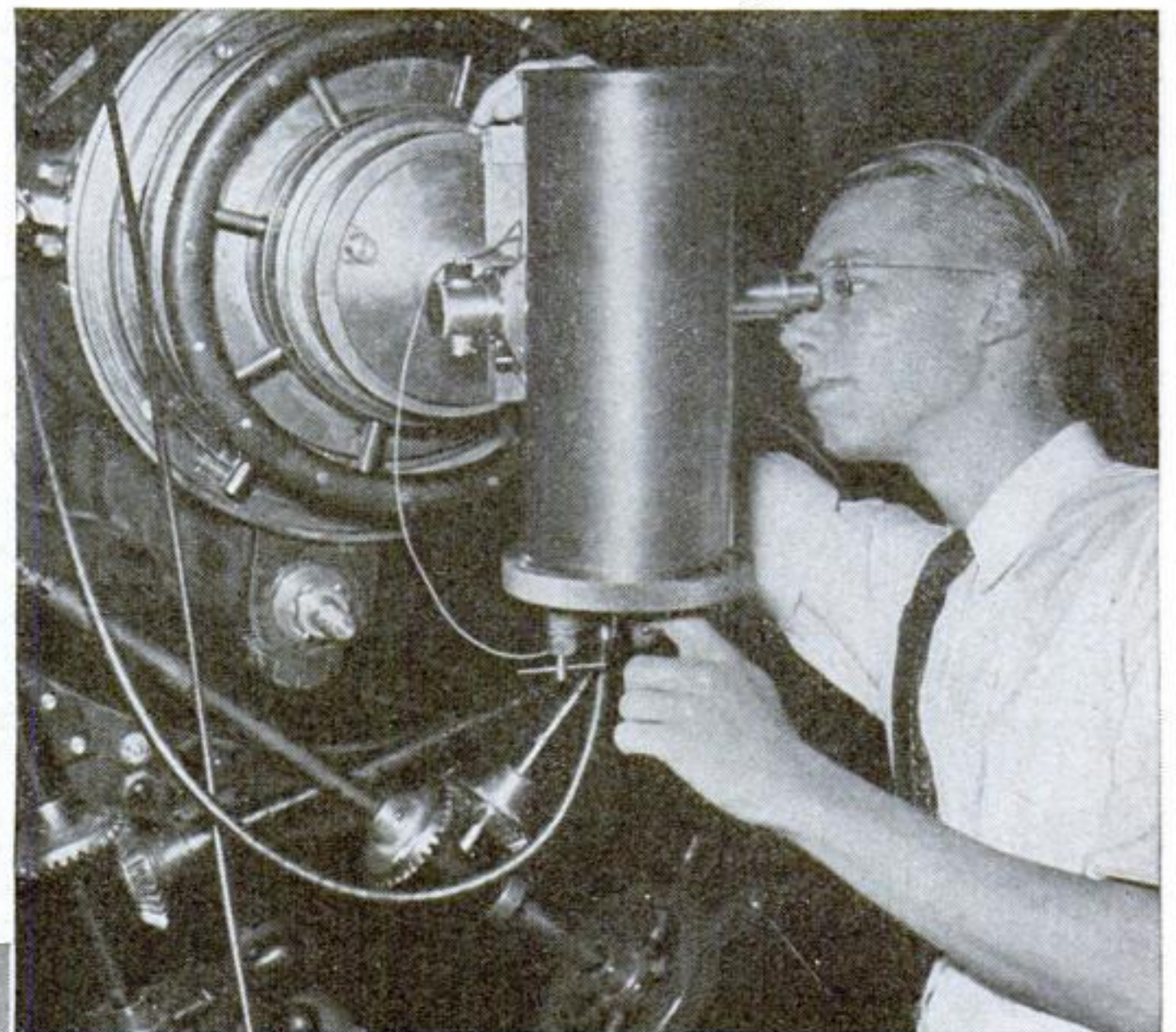
One of the most photographed scenes in the world—a view from a factory roof in Rochester, N. Y., used for snapshots to test cameras

Electric Eyes Measure Differences in Star Brightness

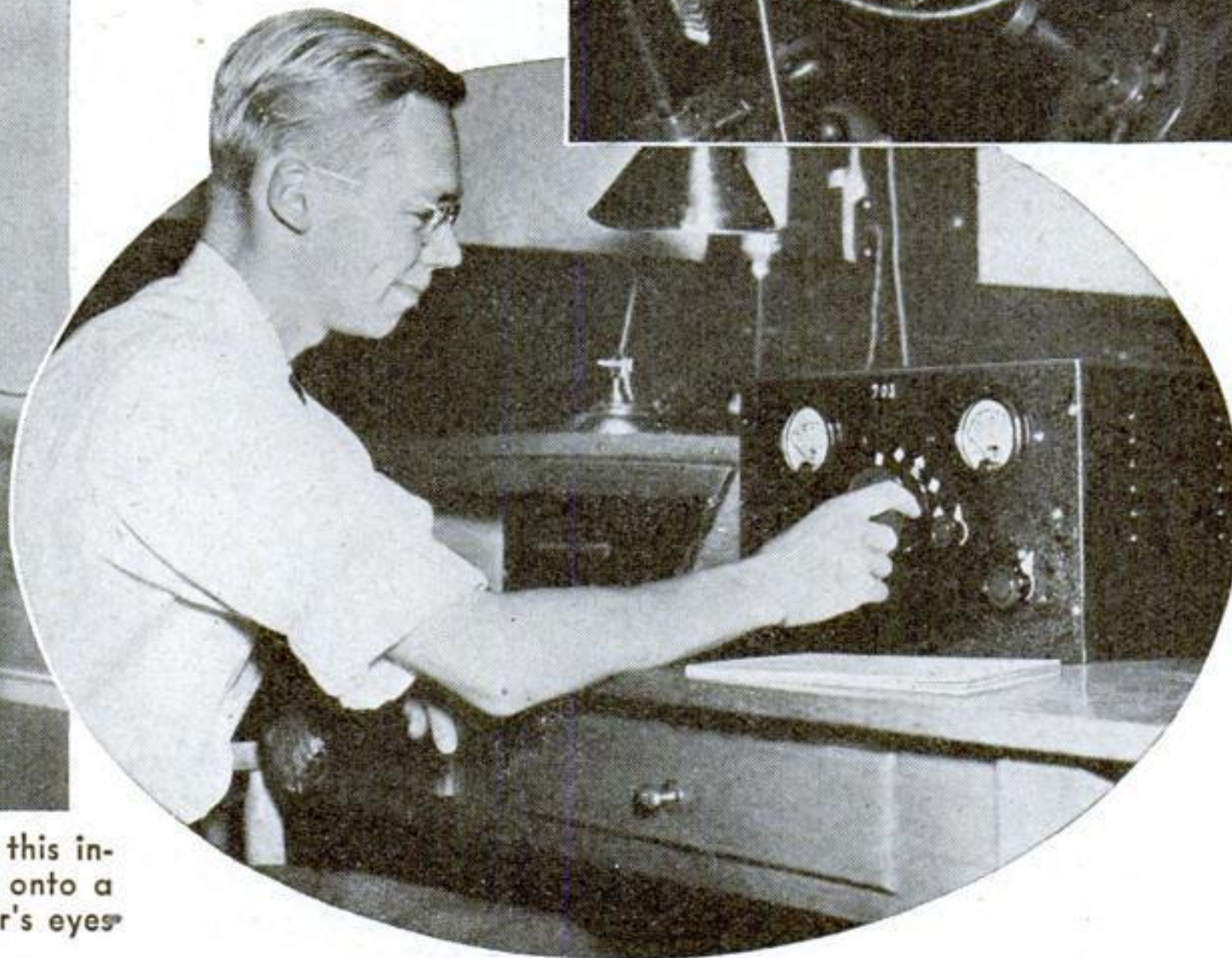
STAR BRIGHTNESS, used by astronomers to estimate stellar distances, is accurately measured by two photo-electric-cell instruments constructed at Lick Observatory, Mount Hamilton, Calif. One device, attached to the telescope, measures the direct starlight and registers variations in light intensity 100 times as minute as can be detected by the unaided eye. The other, used on astronomical photographs, can measure the brilliance of fainter stars but is less accurate. Light falling on photo-electric cells in the instruments sets up a current that is amplified two million times and then measured by an electric meter. The star gauges are expected to prove valuable in providing astronomical data.



Light intensity of stars is measured in this instrument by a beam of light reflected onto a ground-glass screen above the observer's eyes.



The new photometer attached to the big thirty-six-inch telescope at Lick Observatory, Mt. Hamilton, Calif. Here it is being operated by direct starlight.



In the basement of the observatory, a technician regulates the apparatus and takes readings from the sensitive meter actuated through a photo-electric cell.



Egg Within an Egg Is a Rare Freak

FOUND by a Los Angeles, Calif., chef, the freak egg shown in the photograph above proved to be two eggs in one. When it was broken open, a second, smaller, hard-shelled egg was discovered on the inside. Eggs of this type occur in nature much less frequently than freak eggs having double or triple yolks.

Trapdoor Truck Fights Fire or Poison Gas

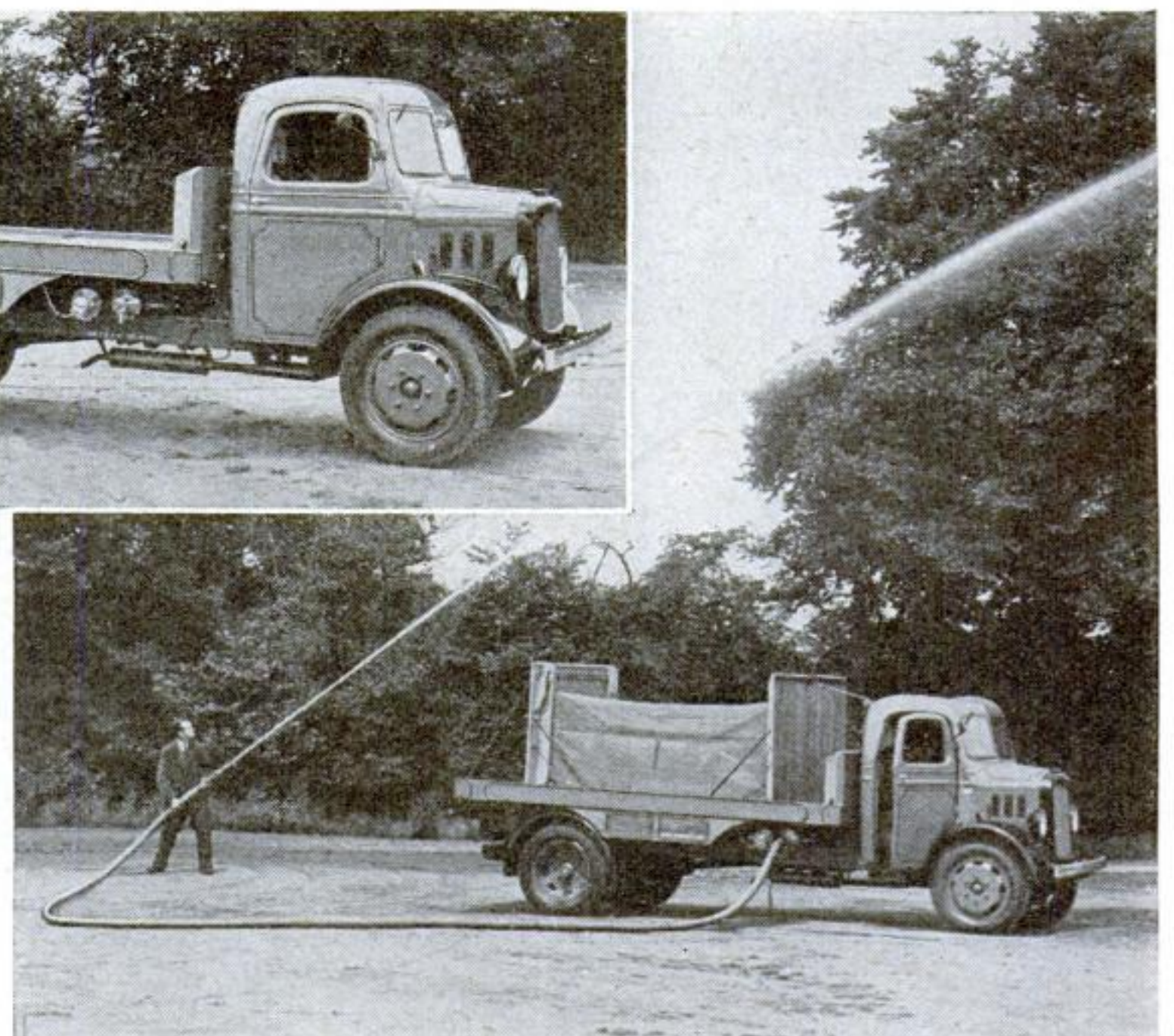
TRAPDOORS on the floor of a new truck of British design adapt the vehicle for emergency use in fighting fire or to counteract poison gas. When the doors are raised, they draw up two canvas sides to form a watertight 600-gallon

reservoir that can be filled with water to be sprayed onto a fire through a hose. In wartime, chemical solutions in the reservoir could be sprayed into the air to neutralize the effects of poison gas laid by enemy aircraft.

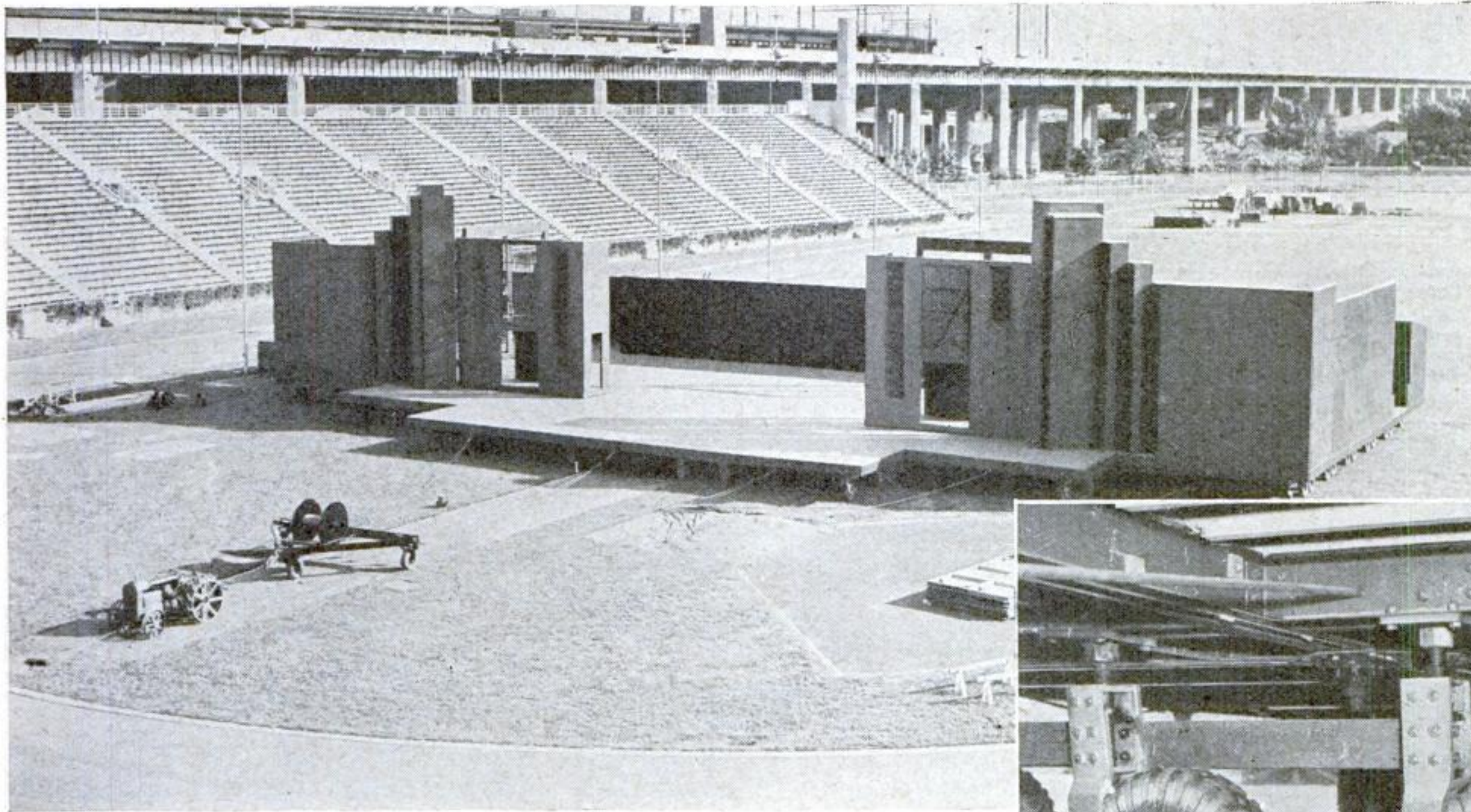


The truck as it appears in everyday use. Special pumps are provided for its emergency service.

Trapdoors are raised from the floor to support the canvas walls of a tank for chemicals.



Mammoth Outdoor Stage Is Mounted on 224 Balloon Tires

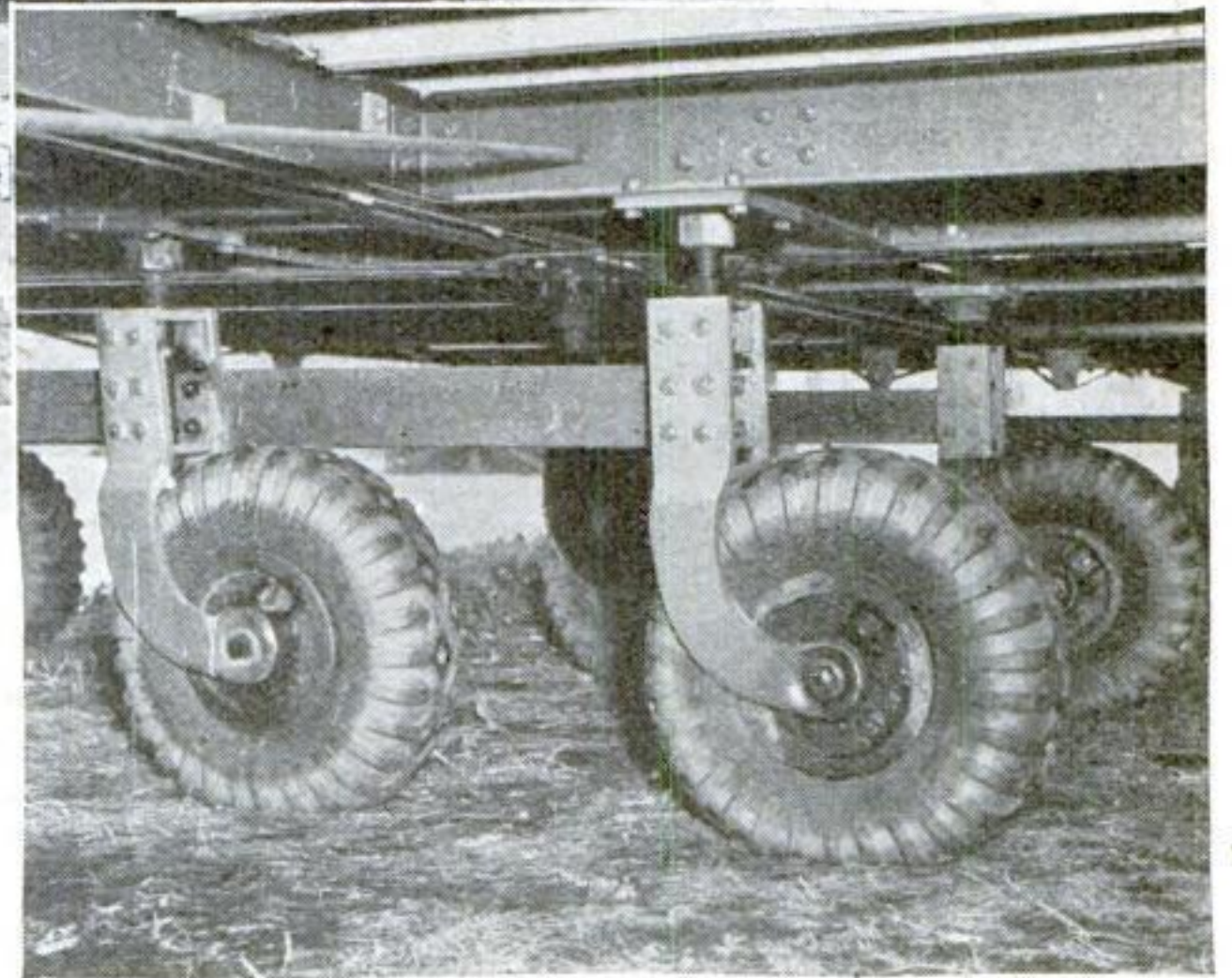


Grand opera and musical comedies can be presented on this giant outdoor movable set

A few of the 224 caster-type wheels on which the stage is rolled into its position

CALLED the largest of its kind ever built, a 150-ton movable stage has just been completed for outdoor entertainments in a New York City stadium. Roofless, the giant stage is supported by 224 truck-type balloon tires, and is rolled into position by a tractor and a complicated pulley system. Although

the huge structure has a stage 140 feet wide, and six dressing rooms built into the wings, it can be dismantled in one hour into fifty-three separate sections for shipment to a new location.

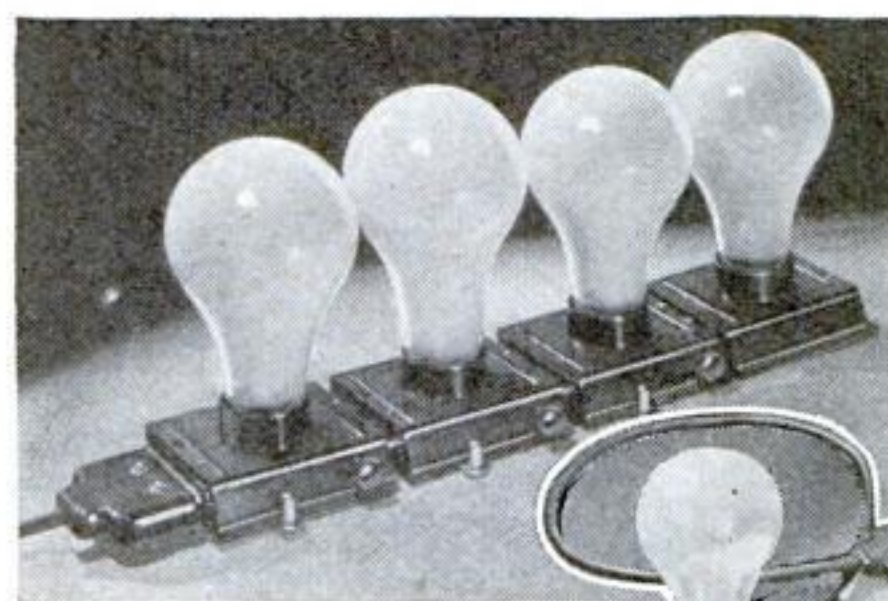


Odd Playground Gate Bars Older Children



Children must pass through without stooping

CUT OUT of a high, galvanized-iron fence and roughly resembling a key-hole, a silhouette of an average ten-year-old child serves as an entrance gate to a new playground for small children in an eastern city. Only those boys and girls who can pass through the silhouette opening without stooping or squeezing through sideways are allowed to enter the play area. The photograph above shows a playground instructor halting a girl who is too tall to enter without stooping.



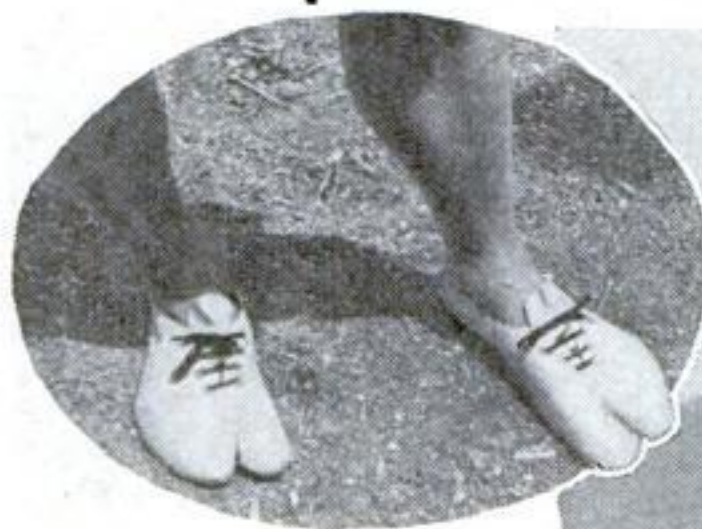
Flasher units plugged together and, at right, with connecting wires

Flasher Sockets for Signs

BULB sockets of new design contain built-in flashing apparatus so they may be used for animating advertising displays.

The sockets can be plugged close together, or connected into detached units or groups. A knob on each unit regulates its flashing speed, while a switch makes it possible to light two or more connected bulbs at once.

Japanese Runners Wear Mitten Shoes



ACCUSTOMED in daily life to wearing sandals held on by straps passing between the first two toes, Japanese athletes run marathon races in odd shoes with divided tips. The big toe of each foot has a separate compartment, making it resemble a mitten.



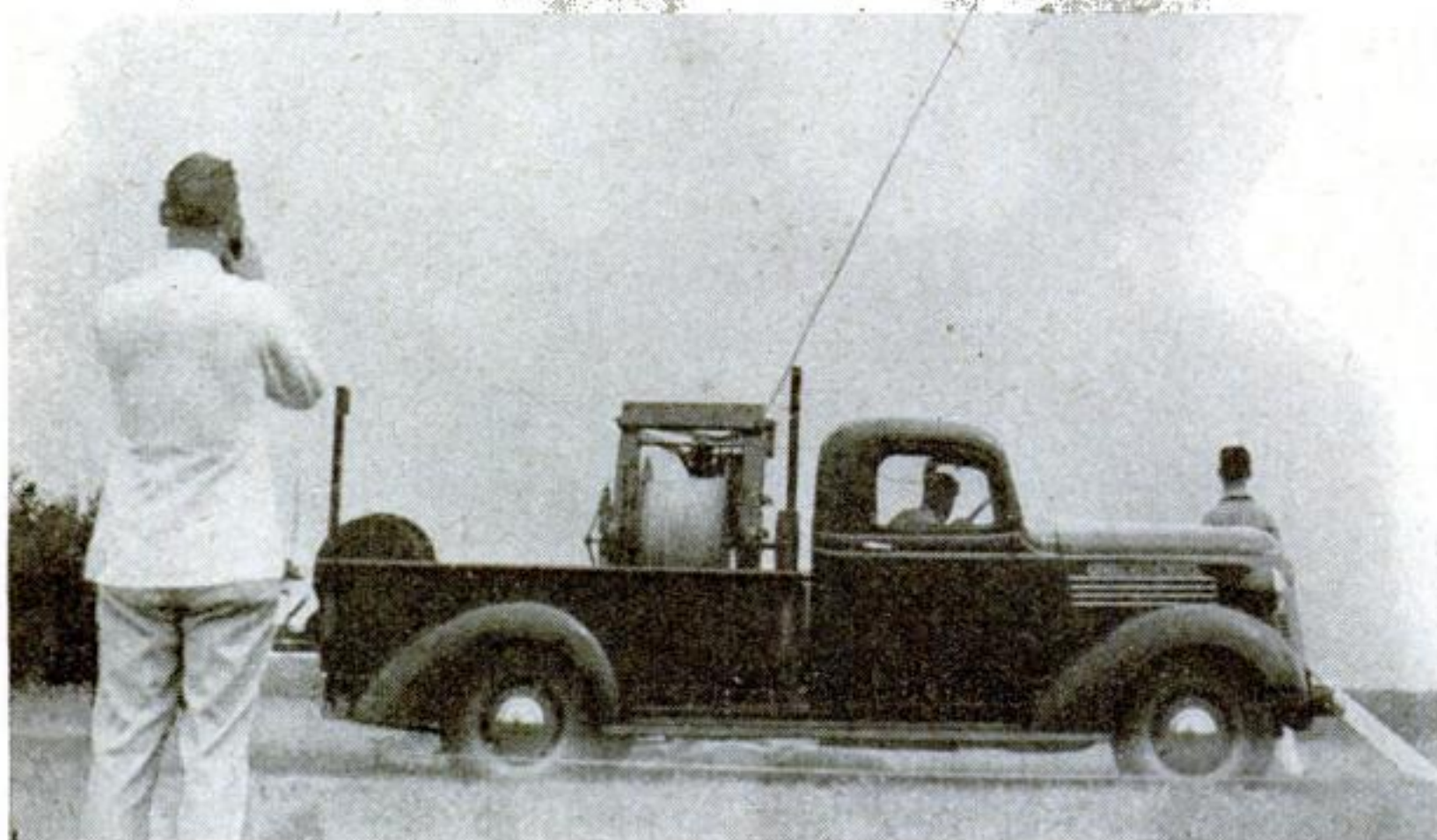
Japanese runners using odd divided shoes like those seen in inset

Power Winch Launches Gliders

MOUNTED on a truck, a power winch is now used to launch gliders. A rope from the drum is attached to a glider placed some distance away, and the winch is revolved, hauling the glider forward for a take-off. If the pilot, on reaching the desired altitude, is unable to release the line, the winch operator trips a sharp blade which knifes the rope free from the drum.



Adjusting the knife that can be used to cut the towing line



A general view of the truck as it launched a glider at a recent meet



Police Play Motor-Cycle Leapfrog

PLAYING leapfrog over a speeding motor cycle was the daring stunt performed by English police at a recent exhibition in London. Facing an oncoming motor cycle, the jumper spread his legs and vaulted over.



Motorized Toothbrush Leaves Hands Free For Shaving

AS A novelty feature at a recent exhibit of inventions, one inventor displayed the odd motor-driven toothbrush above. Said to be the last word in time-savers, the device is designed to allow the late riser to get his teeth brushed while he shaves. A conventional brush is attached to a vibrating arm on the brushing apparatus.

Book Has Living Plant Illustrations

LIVING plants illustrate a giant textbook on botany prepared by George Olin, a Los Angeles, Calif., collector of cactuses and other plants. As shown in the photograph below, a description of the plants is written on the left-hand page, while actual plant specimens grow in soil held in special pocketlike compartments on the opposite page.



Pockets of soil hold the living plants that form the illustrations for this book

Radium Is Filmed for a Movie

ELABORATE precautions were taken to protect cameramen and directors from the injurious emanations of radium when a short feature movie showing the marvels of the precious element was produced recently at a Hollywood studio. Wearing rubber gloves impregnated with lead, a research expert reached through holes in a leaden barrier to handle the \$250,000 radium capsule before the camera. The latter, mounted on a dolly, also was protected by a lead sheathing to insure the safety of the cameramen and crew standing behind it. In the photograph at the right, both technicians are wearing protective aprons.

A cameraman and technician making movies of a capsule of radium. Note the shields

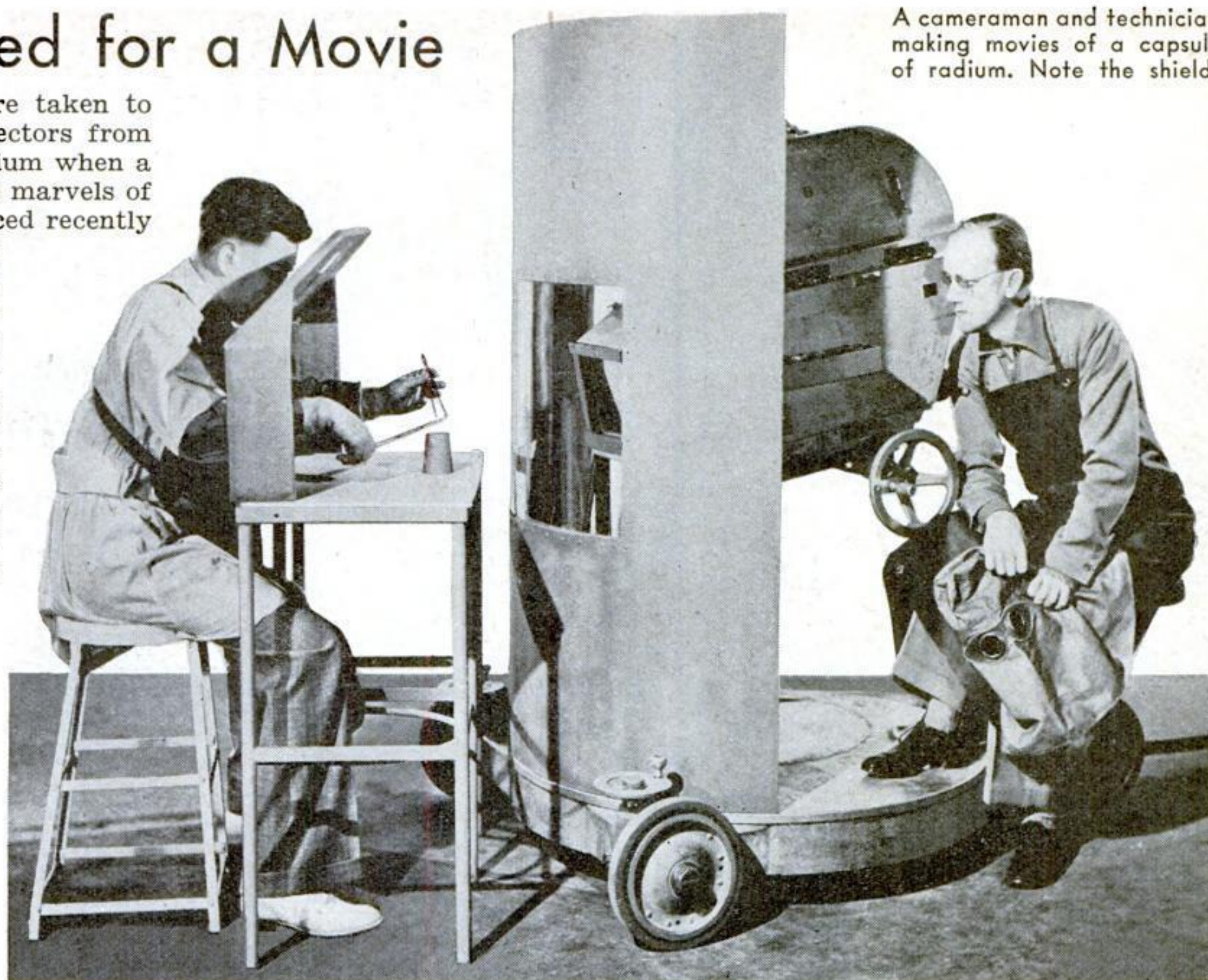


Figure-8 Headlight Warns of Train

CASTING a gyrating beam of light in the form of a figure 8 on either side of the track, a new-type locomotive headlight is designed to serve as a warning and to reduce the number of grade-crossing accidents.

Microphone and Amplifier Show Voice Defects

ENUNCIATION, accent, and other factors in correct voice production are cultivated with the aid of an electric sound system at an institution in Philadelphia, Pa. As the student speaks or sings into a microphone, her voice is reproduced by an amplifier so that she can hear her own voice defects. In the photograph below, a student is singing while lying on her back, as an aid to learning the control of the singing voice.



Singers hearing their own voices through an amplifier. The one above is lying on her back as an aid to learning to control the voice

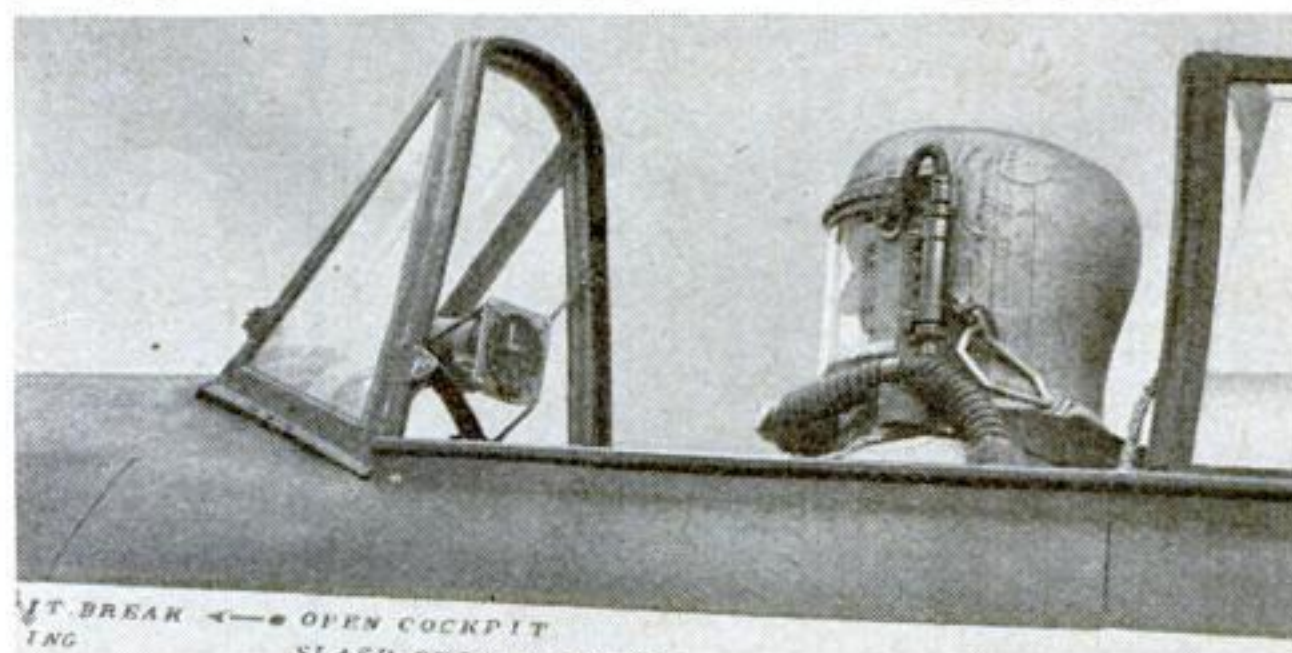


New Phone Attachment Dials Numbers Wanted

TWELVE numbers frequently called are automatically dialed on a telephone by a new mechanical attachment. When the user sets a pointer at a desired number and presses a lever, the apparatus spins the dial.

Altitude Plane Carries Rescue Directions

WHEN Flight Lieutenant M. J. Adam of the British Royal Air Force recently soared aloft from Farnborough, England, to a new altitude record of 53,937 feet, rescue instructions were stenciled on the outside surface of the fuselage of his plane in case he crashed or lost consciousness on landing. The directions told possible rescuers how to open the sealed cockpit cover and the procedure to follow in removing the pilot from the special high-altitude flying suit which is seen in the photograph.



DO NOT BREAK GLASS
SLASH SUIT WITH KNIFE IN COCKPIT TO GIVE PILOT AIR. CUT AWAY ALL STRAPS & REMOVE PILOT FROM AIRCRAFT REMOVE SUIT AS IN INSTRUCTIONS CARRIED BY PILOT OR CUT AWAY IF NECESSARY. KEEP PILOT WARM WHEN SUIT HAS BEEN REMOVED. GET A DOCTOR.

Pilot in high-altitude flying suit, and instructions for rescue

Identifying an old seal by comparing it with the coats of arms in a book of heraldry



Some of the ancient seals that Leo F. Herrington inherited from his engraver ancestors. He is seen below at the bench where he plies the same trade



The impression at the right contains a curious beehive device. Below is a book of metallic cards on which designs have been drawn with a stylus to serve as patterns for engraving dies



SOLVING THE SECRETS OF Ancient Coats of Arms

TRACING seven centuries of English history as represented in a unique collection of 600 wax seals of the type once used on letters and documents is the novel hobby of Leo F. Herrington of Akron, Ohio. Descendant of a long line of English engravers who made dies for the seals used by the nobility, Herrington inherited an invaluable collection of wax "proofs" preserved as models.

In tracing the identity of a particular seal, Herrington and his two associates consider the design and the motto as their best clues. If these fail, they resort to old books of history and heraldry, and even analyze the color and composition of the wax. Each detail on the seal has a definite meaning if it can

be puzzled out, and when all the data are considered together, the seal may relate much of the history of its former owner.

Oldest of the seals in the collection dates back to the thirteenth century, while the most recent was made in 1833. Many have been established as belonging to personages or families well known in history, most of them in Great Britain. Several, however, originated in other countries, including one unidentified oriental seal that is inscribed in Arabic. The fame of Herrington's collection has already spread so that amateur genealogists shower him with requests for information that will help them trace family trees back into the remote past.



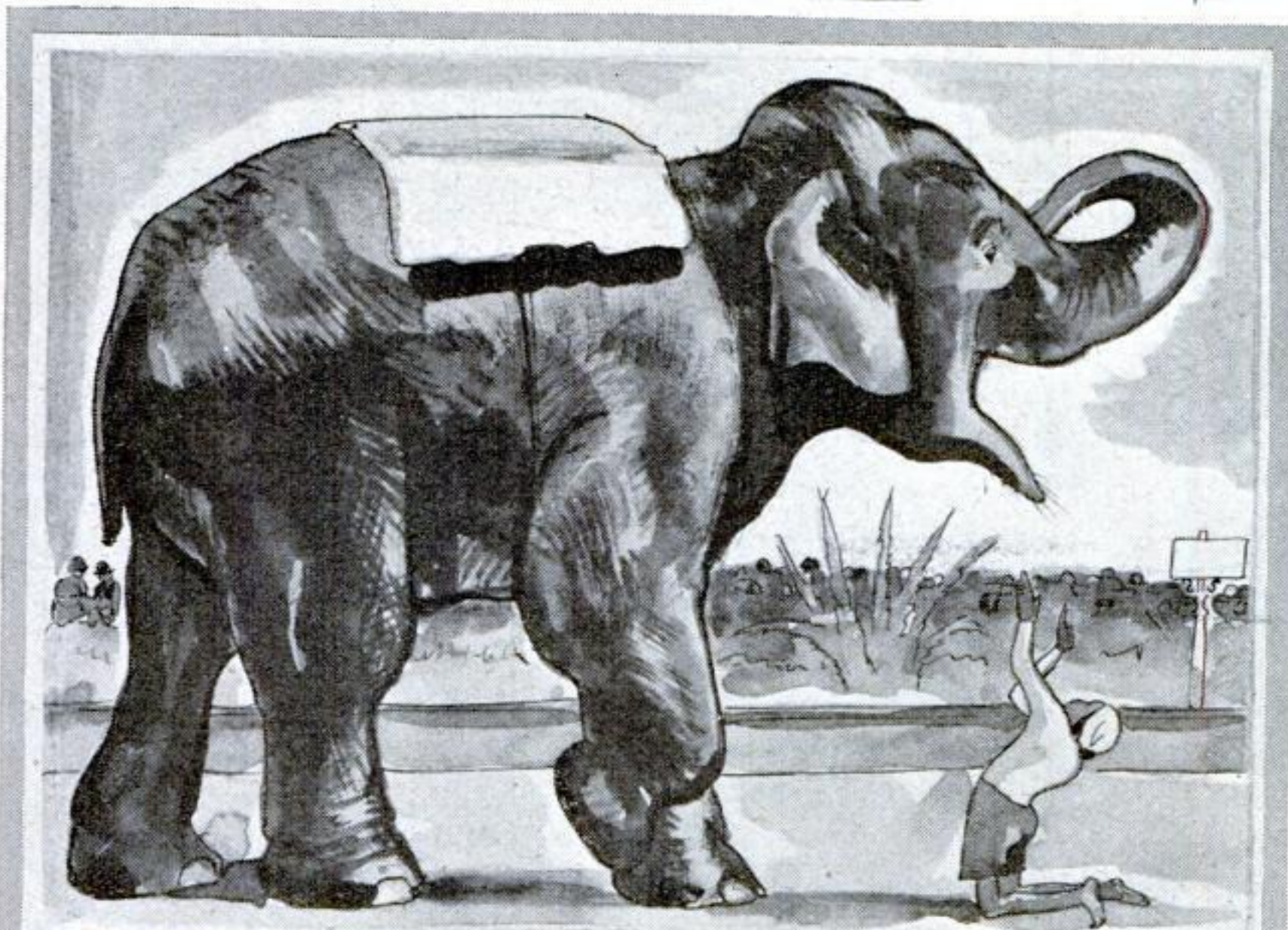
Some more of the 600 seals in the valuable collection. Less than 100 of them are identified

Un-Natural History By GUS MAGER

HOW WOULD YOU LIKE TO GO FISHING IN ECUADOR, WHERE **EARTHWORMS** GROW UP TO FIVE FEET LONG? ONE WORM IS ALL YOU'D NEED TO DIG FOR A DAY'S FUN!



A **HORSE** IN ROSELAND, N.J., SPORTS A GENUINE MUSTACHE, WITH HAIRS AS DENSE AS THOSE OF A SHAVING BRUSH! PULLING A MILK WAGON, HE CREATES A SENSATION ALL ALONG HIS ROUTE, AND HAS TO BE SHAVED EVERY FOUR WEEKS OR HE'D LOOK LIKE A BOLSHIEVIK!

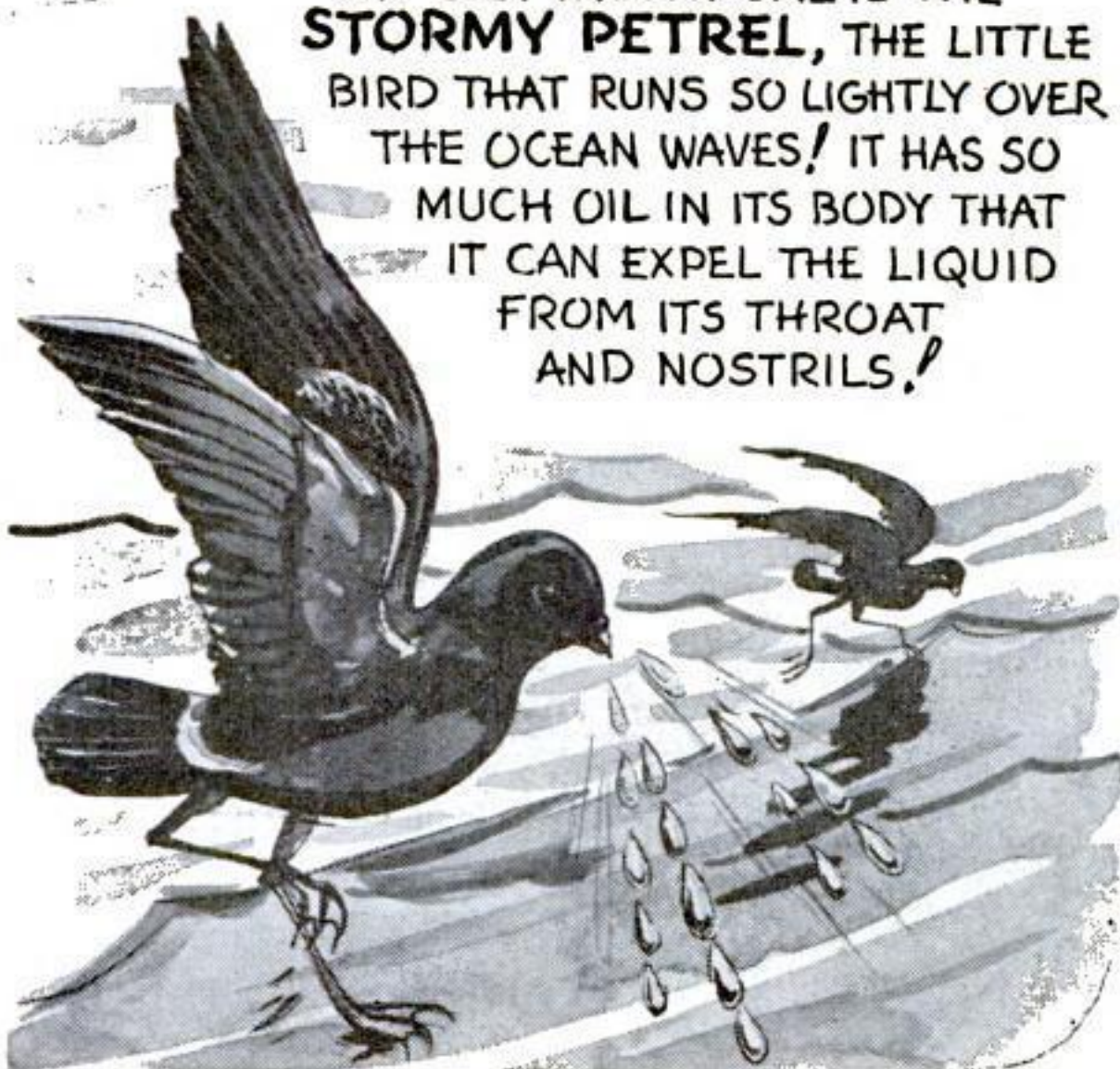


ELEPHANTS SOMETIMES GO ON STRIKE! NOT LONG AGO, A WELL-KNOWN SPECIMEN AT A ZOO IN LONDON, ENGLAND, FLATLY REFUSED TO GO ON WITH HIS WORK OF CARRYING PASSENGERS AROUND THE ZOO GROUNDS. AN ASIATIC MAHOUT WAS ENGAGED TO PARLEY WITH THE BEAST, AND THE STRIKE WAS SETTLED—PROBABLY WITH THE PROMISE OF AN EXTRA BALE OF HAY FOR OVERTIME!



IN SOME KINDS OF **SHREW MICE** THE GLANDS THAT GIVE THE BABIES NOURISHMENT ARE LOCATED ON THE BACK! FOR INSTANCE, THE LONG-NOSED **ELEPHANT SHREW** CARRIES ITS YOUNG SIDE BY SIDE ON ITS BACK WHILE NURSING THEM!

AN OILY INDIVIDUAL IS THE **STORMY PETREL**, THE LITTLE BIRD THAT RUNS SO LIGHTLY OVER THE OCEAN WAVES! IT HAS SO MUCH OIL IN ITS BODY THAT IT CAN EXPEL THE LIQUID FROM ITS THROAT AND NOSTRILS!



WHEN IT COMES TO BEING USEFUL AROUND THE HOUSE, A EUROPEAN TOAD CALLED **ALYTES OBSTETRICALS** TAKES THE CAKE! FROM TWO TO FOUR TIMES A YEAR THE FEMALE LAYS A LONG STRING OF EGGS LIKE A NECKLACE, AND THE MALE WRAPS IT AROUND HIS BODY AND CARRIES IT AROUND FOR ABOUT THREE WEEKS UNTIL THE TADPOLES ARE HATCHED!

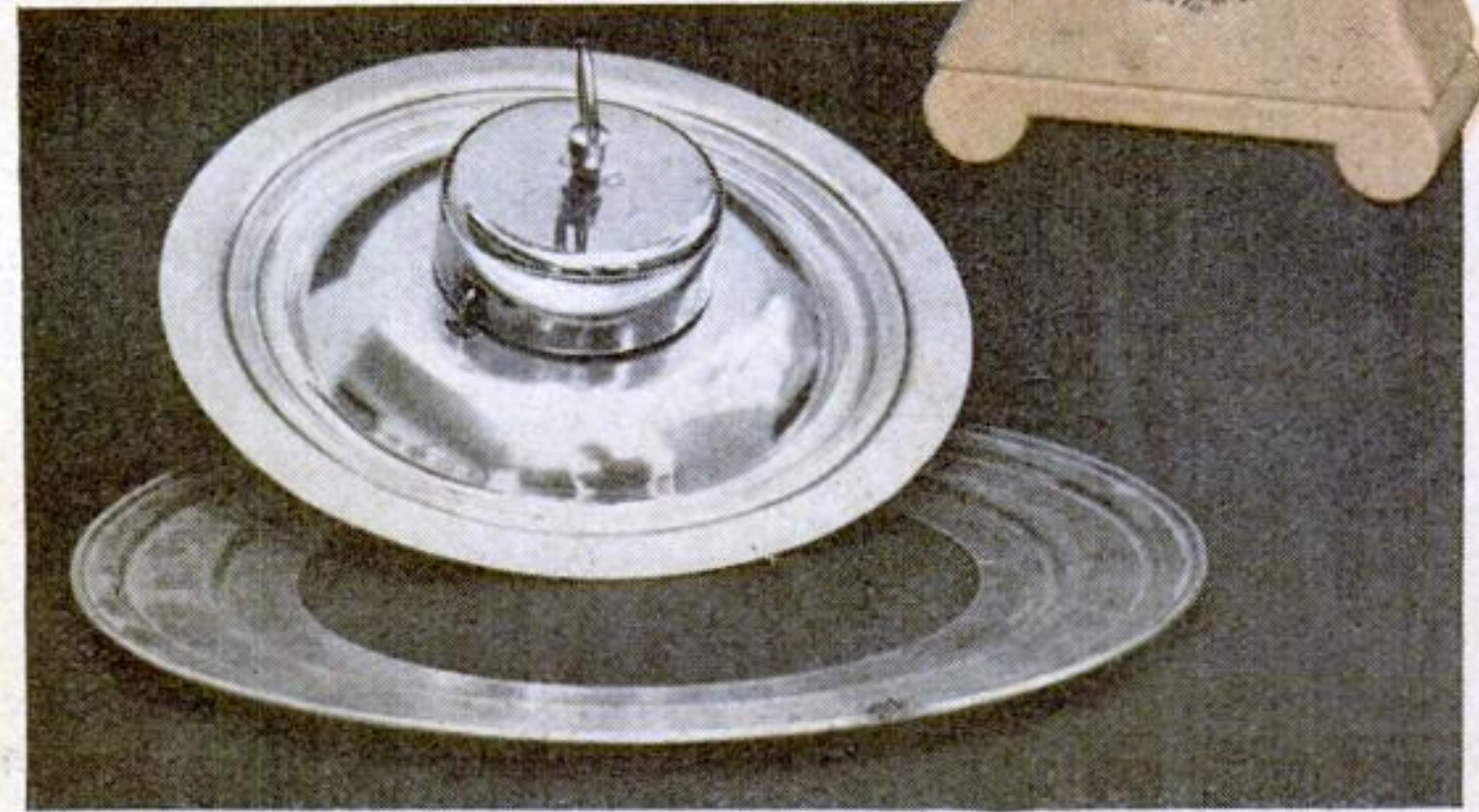


NEW APPLIANCES



BOUDOIR CHAIR. A mirror attached by means of a swivel to the back of a new boudoir chair gives a complete view of the back of the head from various angles. Used in connection with a dressing-table mirror, it is helpful in arranging the coiffure.

TIMERS. Set for any period up to six minutes, the boiled-egg timer at the right informs the housewife with a cheery "cock-a-doodle-doo" when the desired time is up. The ingenious pot cover illustrated below has a built-in timing unit that rings a bell at the end of the required period.

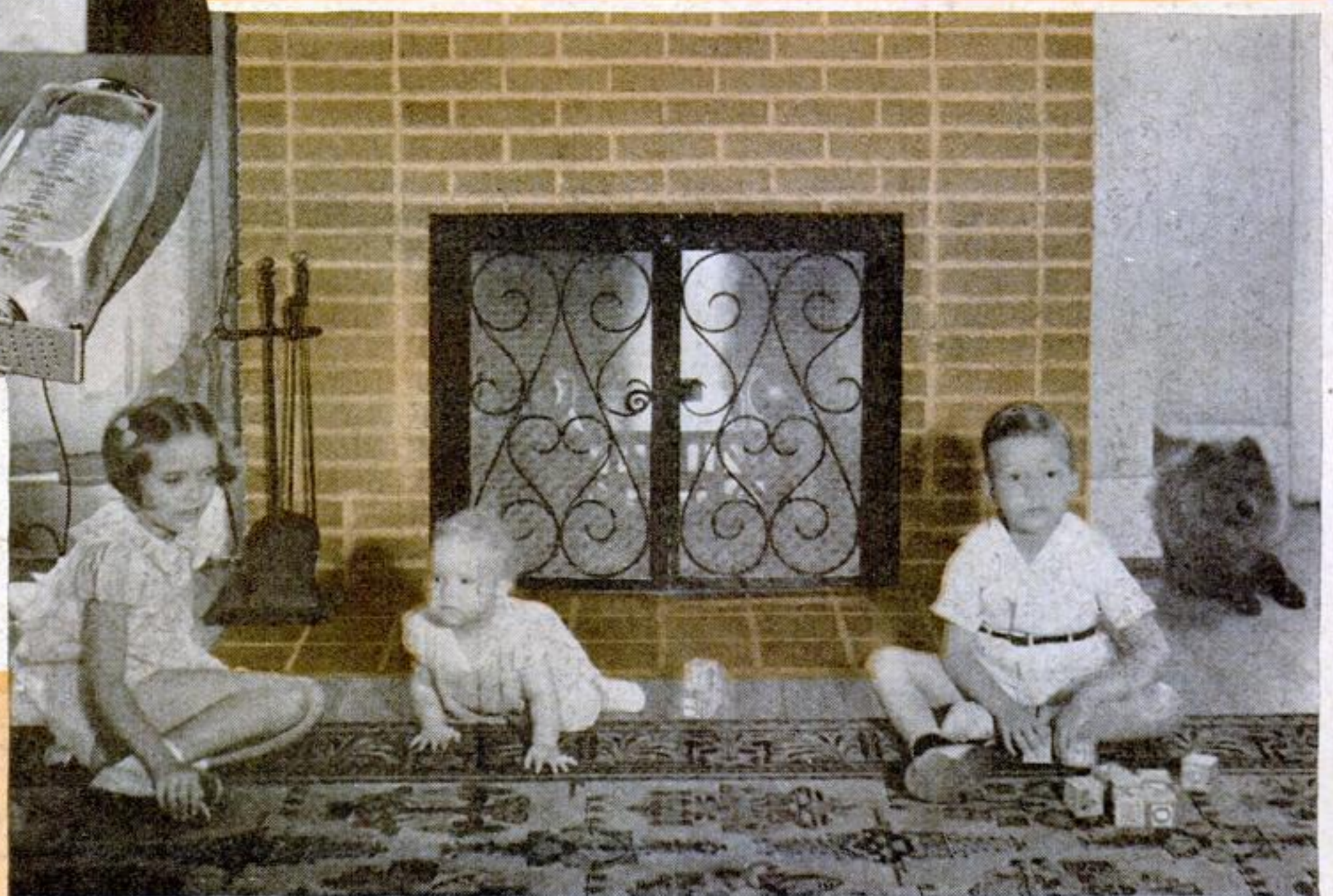


QUICK ELECTRIC COOKER. Twin heating elements in the top and bottom of this appliance give speedy action in cooking, baking, or roasting. A small light inside the cover makes it possible to watch cooking through a small window. Heat units can be used separately, and regulated as required.



STORAGE JARS for staple kitchen supplies now are made of glass with graduated scales marked on the sides. This enables the housewife to measure out quantities called for in recipes, and to check the amounts on hand.

SAFETY FIRE SCREEN. Children are protected from open fireplaces by hinged doors of close-meshed screen which can be locked securely when youngsters play alone.



FOR THE HOME

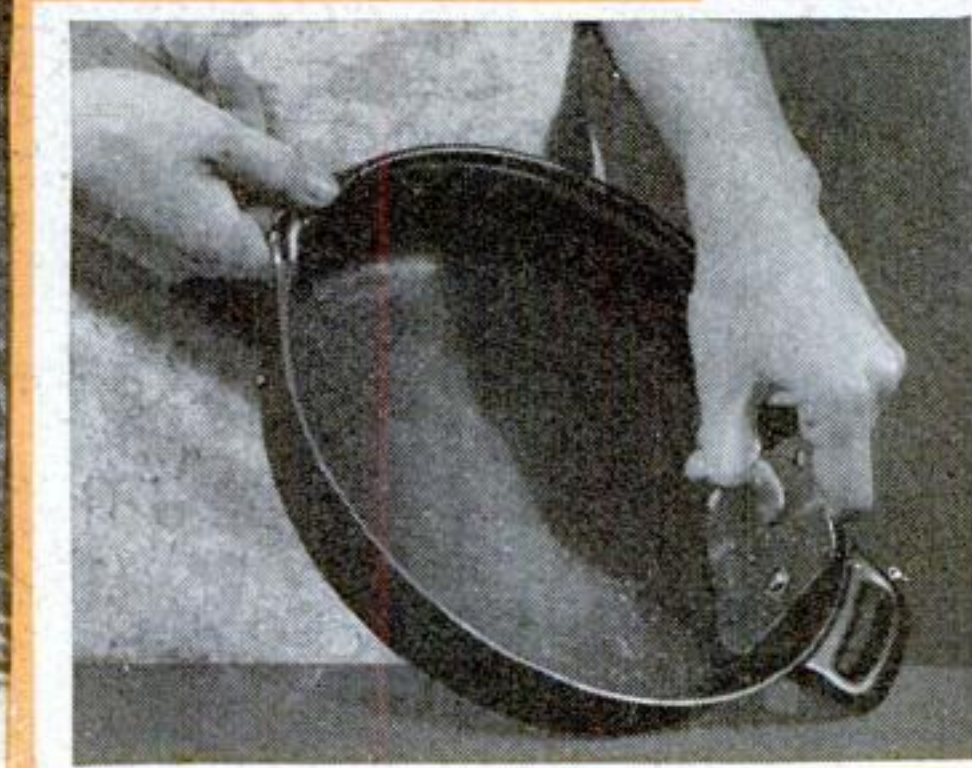


CRISPING OVEN

Used on top of the stove, this utensil re-crisps or warms up food and keeps it that way on the table. An adjustable vent makes it possible either to drive off moisture or to keep it in the food.



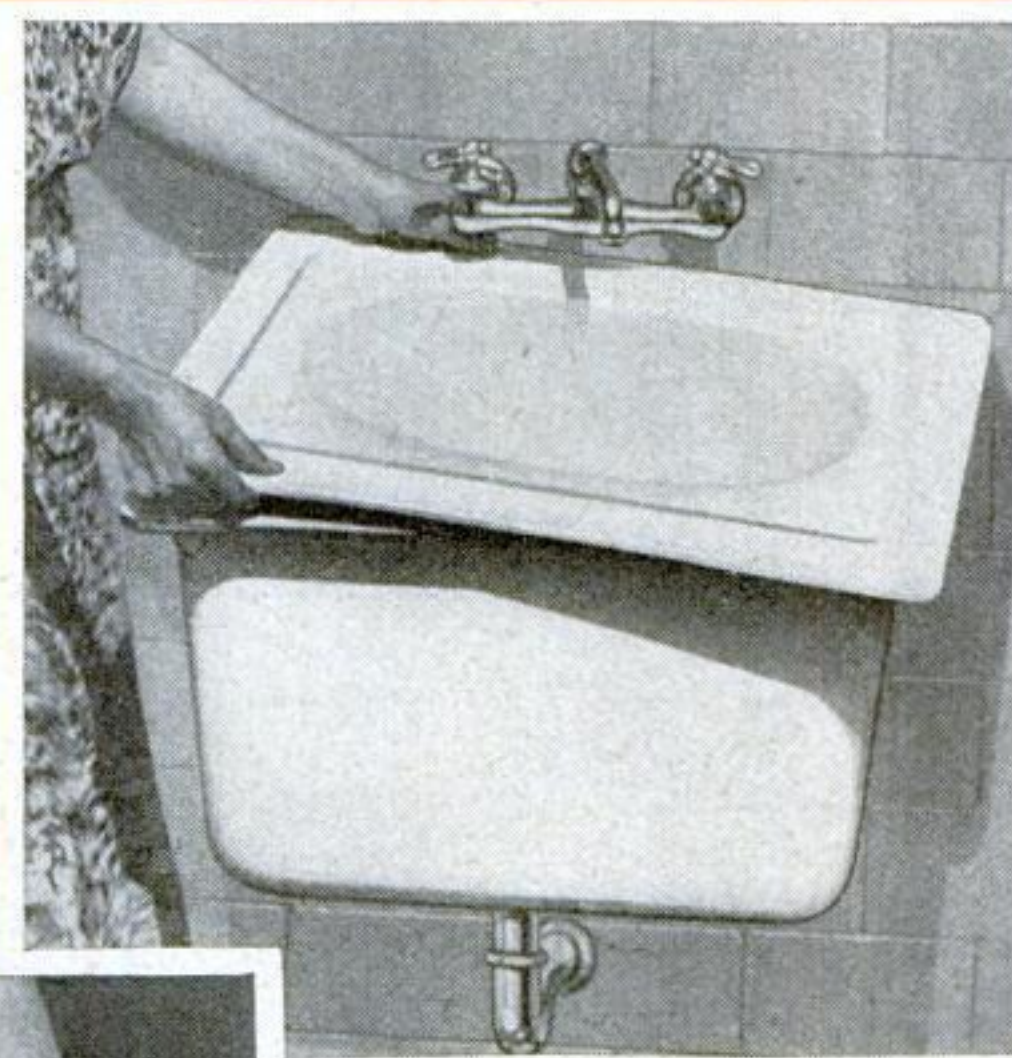
FRUIT-JAR STERILIZER. Shaped like an inverted funnel, the device pictured below is set in an ordinary stewpan and a fruit jar to be sterilized is placed upside down upon it. As water boils in the pan, steam rises from the spout to sterilize the jar.



POT SCRAPER. Made of a special metal that will not mar the surface, the scraper shown at the left reaches all corners of dirty pots, pans, and skillets.



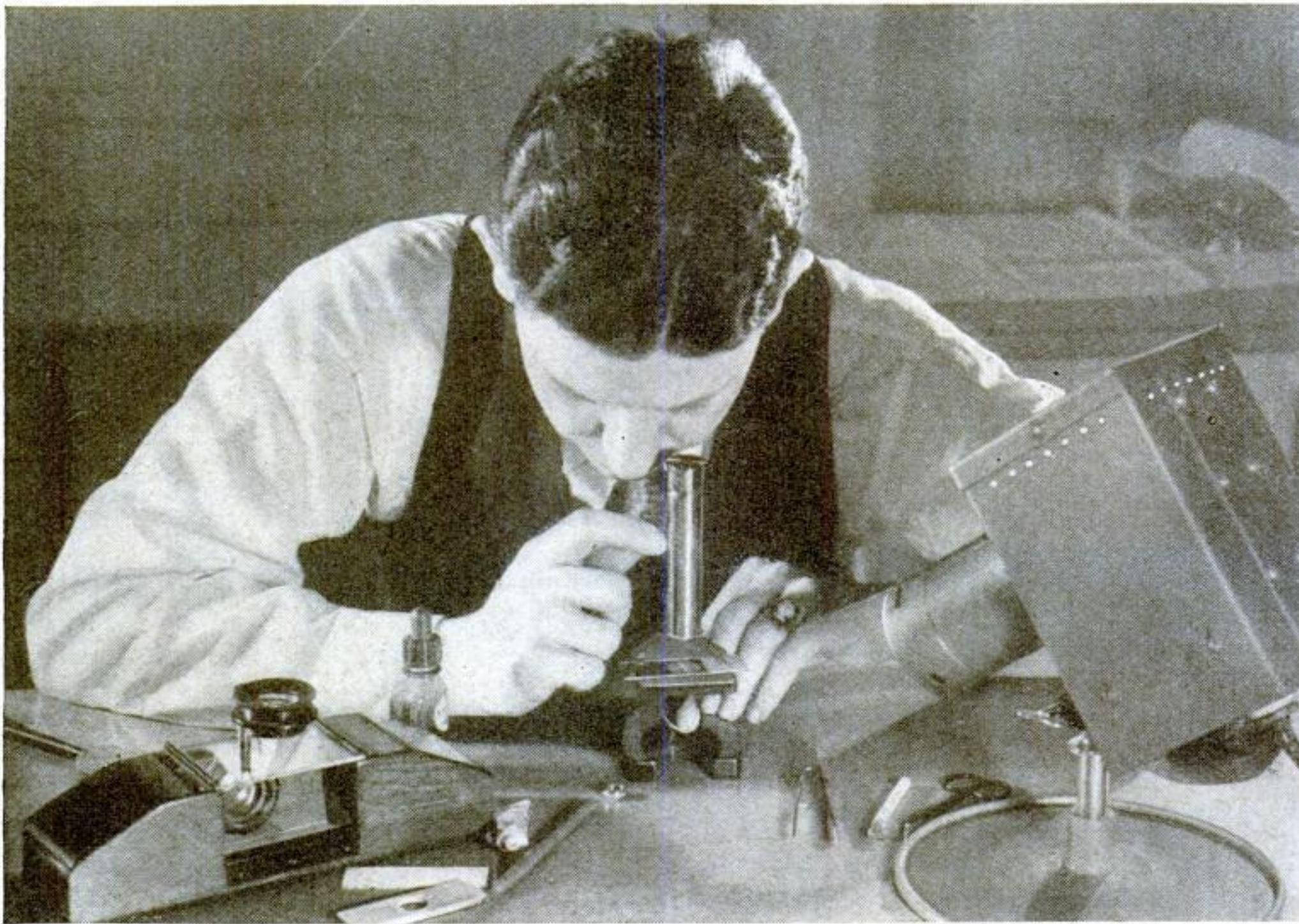
NAUTICAL BAR. Resembling the bow of a cabin cruiser, the novel home bar pictured below is an appropriate fixture for the game or "rumpus" room. The deck house holds bottles and glasses.



PORTABLE WASHBOWL. Set over the top of a laundry tub, this enameled cover converts it into a convenient extra washbowl.

Insect Hairs

PROVIDE INTERESTING SPECIMENS FOR YOUR



The beauty and variety of insect hairs will amaze you as you study them under your microscope

FROM fuzzy caterpillars to sleek mosquitoes, insects are equipped with hair of almost every imaginable form. Hairs decorated with knobs and spines, hairs with other hairs growing from them, hairs that look like fancy spears, and scales of marvelously beautiful form and color all can be found on common insects with the aid of your microscope. The variety of hairs, and of scales (which are a form of hair), is so great that they provide ample material for study with every possible lens power, from the low magnifications of inexpensive instruments to the highest-power laboratory objectives.

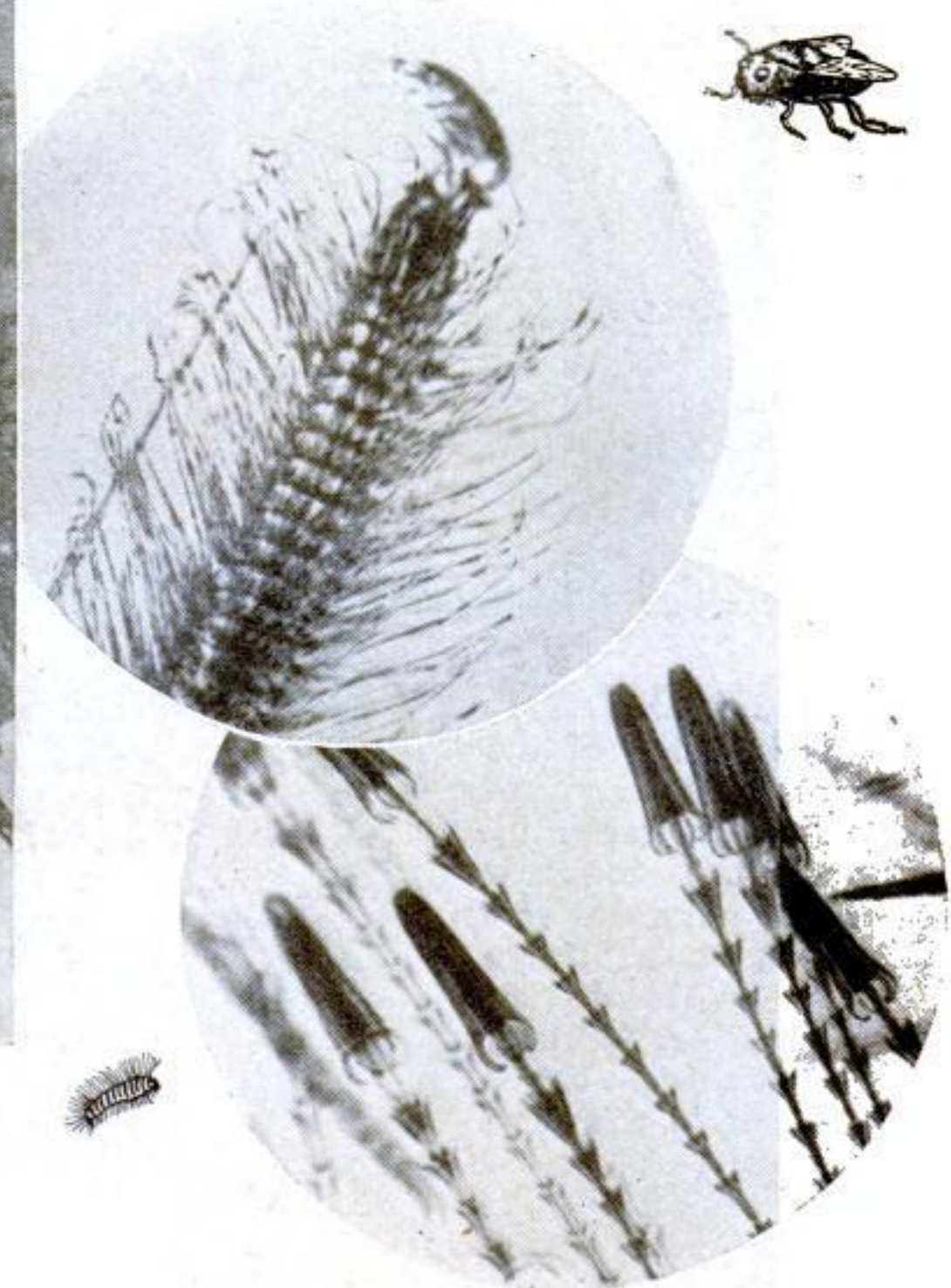
Some insects have few, if any, hairs or scales, while others are completely covered with them. These growths vary in shape from flat, paddle-like scales to cylindrical hairs. Moths and butterflies are the outstanding scale-bearing insects. Their scales are real works of art, with both brilliant hues and pastel colors. Most of the scales are found on the transparent, membranous wings, where they are attached to both surfaces by means of short stems. They lie in overlapping rows much like the shingles on a roof. Scales of different colors are grouped to form the distinctive markings.

The color of scales seems to come from two sources. Some scales contain a pigment between the two membranous layers of which they are

formed, while others apparently are constructed so that their color is an optical effect resulting from the breaking up of light by fine corrugations on their surface, or by the thinness of the membrane, which acts like the thin film of a soap bubble. Butterflies and moths have scales containing color pigment, while members of the beetle family have the iridescent, metallic scales whose color is produced optically.

Scales of different shapes may be found on the same insect wing. For example, on the edge of a mosquito wing, you can observe long, somewhat slender scales having pointed tips intermixed with blunt, stubby ones. Each scale is provided with a stem, by which it is attached to a tiny socket in the surface of the insect's wing, leg, or body. Thus the scale resembles a leaf. The comparison goes

The tongue of a honeybee with its hairy coating. The elaborate hairs in the lower circle were taken from a beetle grub

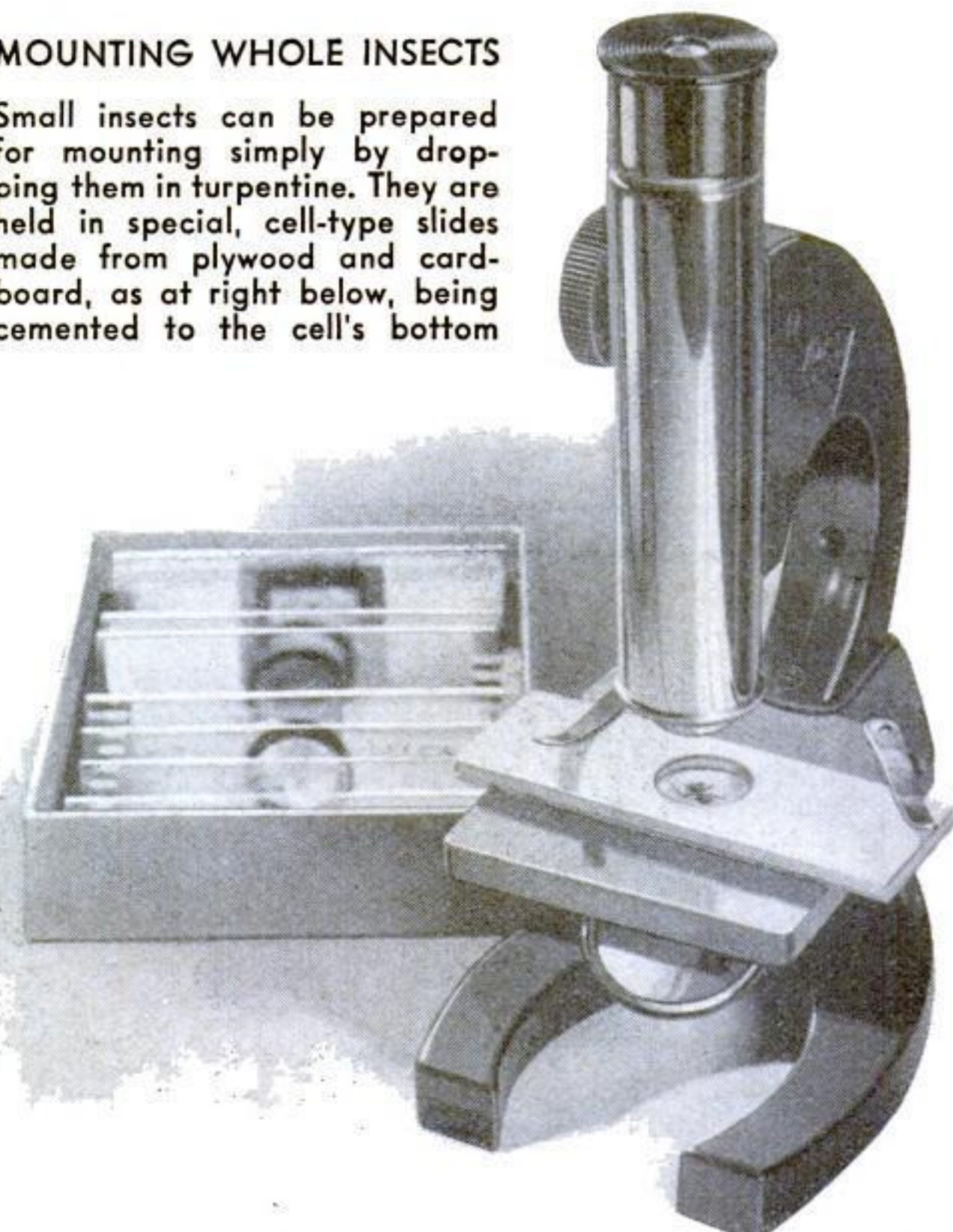
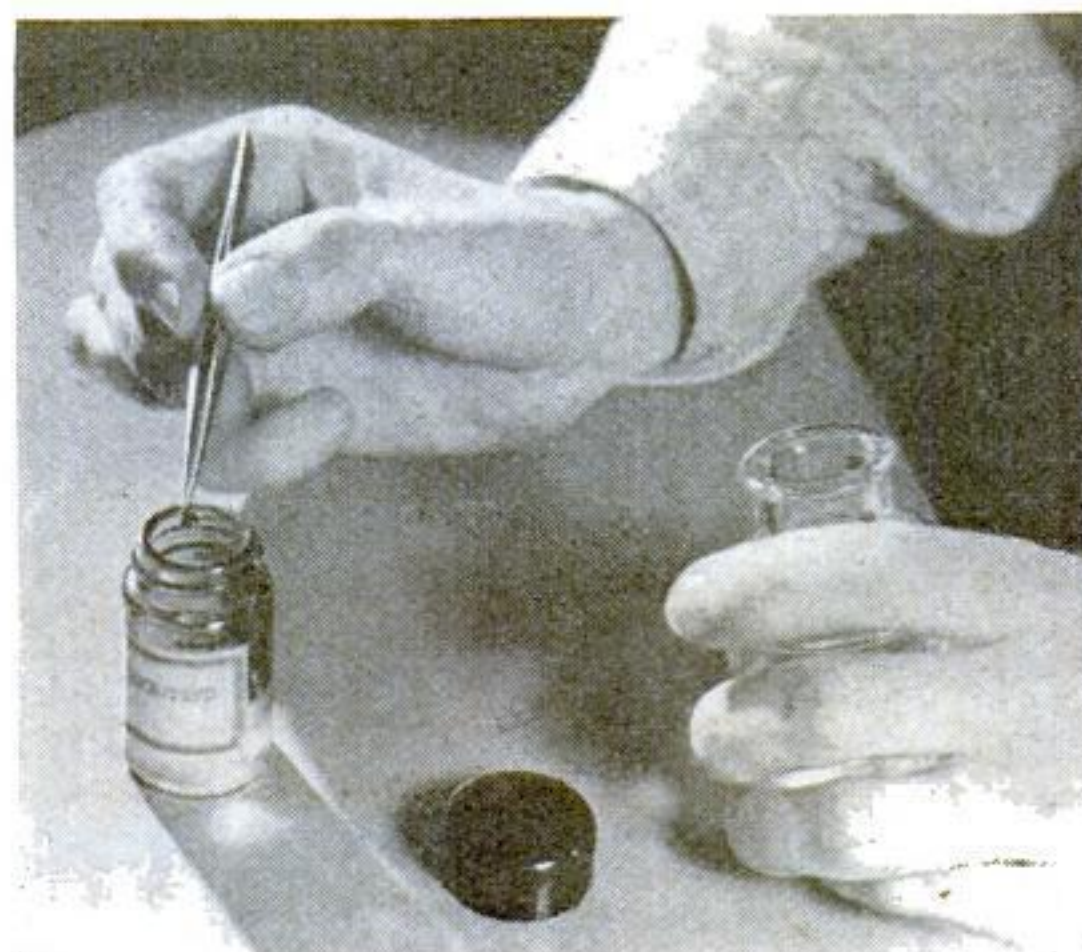


even further, for, like the leaf, the typical insect scale is composed of two membranes lying close together. Although it is essentially a hair, its structure suggests that it is an empty cell whose sides have been pressed together. In fact, some insects have scales that are expanded, like a paper bag blown full of air.

The things that make insect scales of particular interest to the microscopist are the surface markings, called

MOUNTING WHOLE INSECTS

Small insects can be prepared for mounting simply by dropping them in turpentine. They are held in special, cell-type slides made from plywood and cardboard, as at right below, being cemented to the cell's bottom



MICROSCOPE

By
MORTON C. WALLING

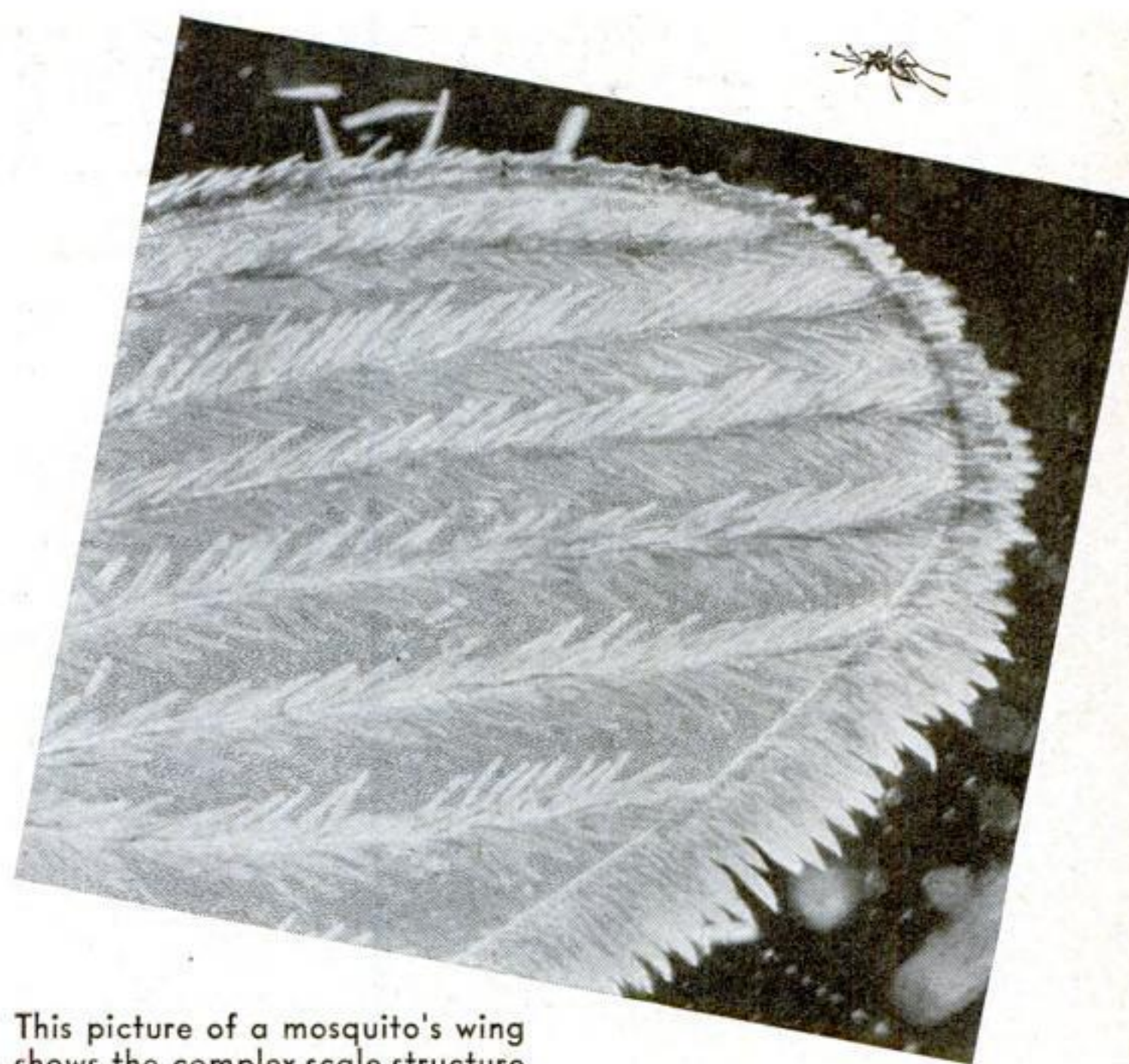
ribs and striations, which can be seen on most of them. Generally the markings consist of ribs running parallel to each other. Sometimes there are connecting cross ribs. Some scales have parallel ribs on one surface, and ribs that diverge from a common point on the other surface.

When these surface markings are so arranged that they cause interference of light waves, the microscopist may see things that actually do not exist. Thus he may observe what seem to be rows of tiny knobs, where actually there are no knobs at all. A wing scale from the gnat or mosquito can be used as an example. The scale consists of a double membrane, on the surfaces of which are parallel rows of stiff ribs. At their ends, these ribs project beyond the edge of the membrane and form bristles or spines. On each side of the scale are fine markings, at right angles to the ribs. Between the ribs can be seen, with a good lens, parallel rows of beads. Microscopists for a time considered these beads as part of the scale structure. Then some one noticed that they seem to extend into space beyond the edges of the scale, and that by varying the angle of illumination, the number of rows of beads between any two ribs on a single scale could be made to vary; two, three, four, or more being pro-

duced at will. This led to the conclusion that the beads are not beads at all, but patterns formed by light interference between the ribs and transverse lines.

Insect scales also form valuable test objects for microscope lenses. The clearness with which they can be seen through a given lens depends on the maximum lens aperture that can be used without letting spherical and chromatic aberration interfere too much. Thus, by looking at a podura scale, taken from an insect called a springtail, which is found around decaying wood and in wine cellars, or at the scale from a butterfly or other insect, you can judge the performance of your lenses by the degree of clearness with which the image is rendered.

Scales are considered as being modified hairs, but in between the conven-



This picture of a mosquito's wing shows the complex scale structure

tional hair of cylindrical form and the typical scale are a great many other forms. There are hairs or spines that resemble flat bayonet blades. Others have fancy appendages and tips that make them look like medieval spears. The larva of [\(Continued on page 128\)](#)

Making Thin Sections of Microscope Specimens

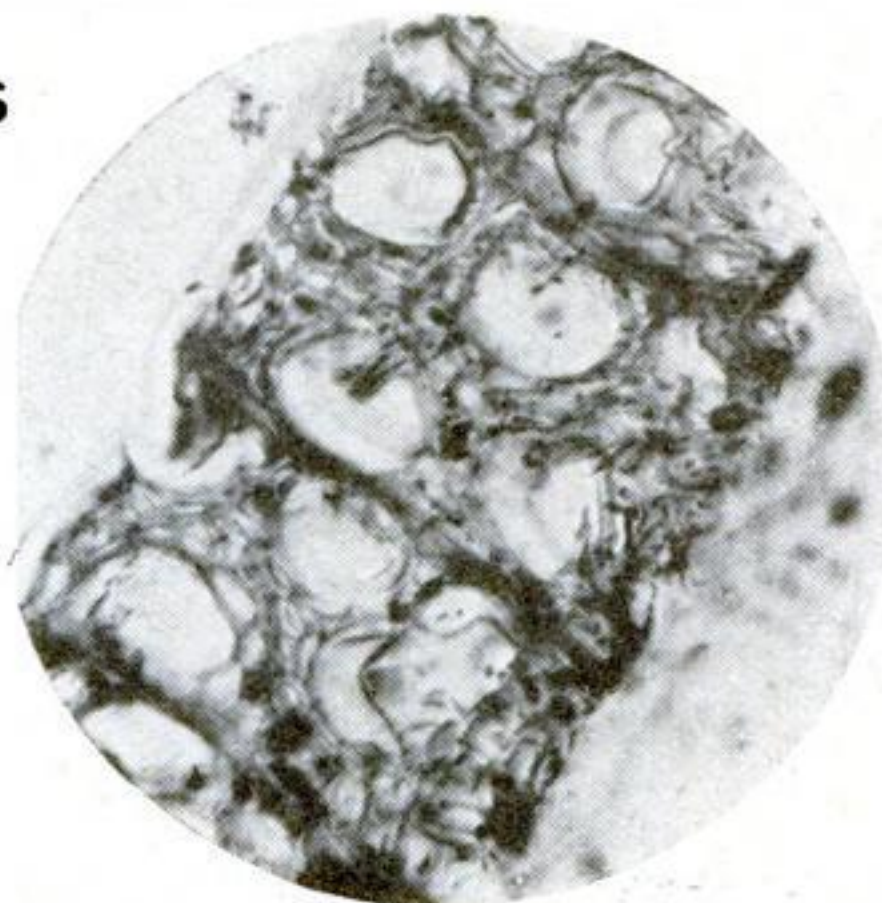


HERE is an easy way to cut thin sections of wood and other specimens without special equipment. All you need is a piece of sheet brass or other non-rusting metal about one-sixteenth or one-eighth inch thick; a very sharp safety-razor blade; some collodion, airplane-wing dope, or celluloid solution; and a jeweler's saw fitted with a blade that makes a cut of the same width as the specimen to be sectioned.

Make a saw cut in one edge of the metal to a depth of about three quarters of an inch, and hone both surfaces of the brass with a razor stone to remove burrs and smooth the area around the cut. Then clean out the notch with a thread.

Thin sections can be prepared by wedging specimen in slotted plate, as above, slicing with razor, and mounting in xylol

Then clean out the notch with a thread.



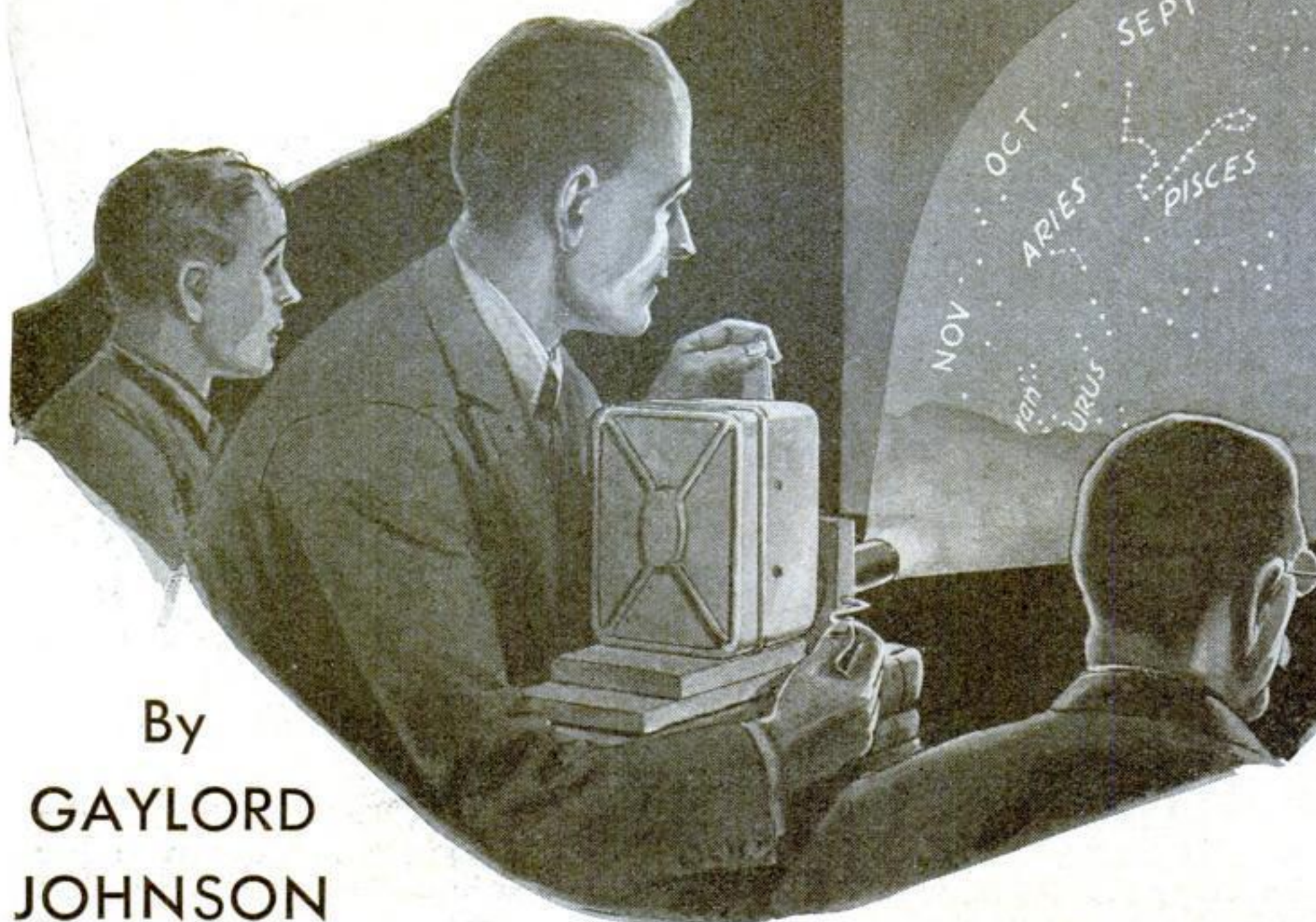
Photomicrograph of a thin wood section

Wedge the piece of wood in the slot so that one end projects above the top of the plate for a short distance, place a drop of collodion on this projecting end, and spread it out in a thin layer. When the collodion film dries, slice it off, along with the projecting bit of wood, by sliding the razor across the metal. Discard this first section.

Now move the wood so that the squared end projects above the metal to the thickness of the section you want—with a little practice, this is easy to judge. Again, apply the collodion, let it dry, and slice off the end. Transfer this section to a little pool of xylol on a clean glass slide, add a drop or two of balsam, and lower a cover glass into place.

Tom Thumb Planetarium

EASILY BUILT FROM ODDS AND ENDS



By
**GAYLORD
JOHNSON**

**SIMPLE PROJECTOR MAKES THE CONSTELLATIONS
MARCH ACROSS A SCREEN IN YOUR LIVING ROOM**

IF YOU ever attended a performance in a large public planetarium, you probably envied the lecturer's ability to rehearse any part of the drama of the skies at will. Or perhaps you never have witnessed the march of the stars across a giant dome, and are anxious to see a man-made sky in action. At a cost of less than a dollar, you can assemble, from odds and ends, a midget planetarium that will put on a performance right in your own parlor.

When you have completed the simple projector described in this article, you can entertain your friends with an illustrated lecture that reproduces many of the big, \$100,000 instrument's astronomical stunts. You can show the nightly procession of the constellations from east to west across the sky. Then, as dawn begins to come, you can make the stars pale and fade out. Across the sky the sun travels along the path of the ecliptic, to set in the west, and in the twilight you can make a young moon appear, just as it does in nature. Your homemade planetarium will enable you to repeat this daily round for your audience as many times as they wish.

Then, simply by changing a little circular projection slide, you can take your audience upon a voyage from your latitude on the earth to the north pole and back to the equator, thence returning to your home location.

You also will be able to use your planetarium to show the seasonal changes in the zodiacal constellations,

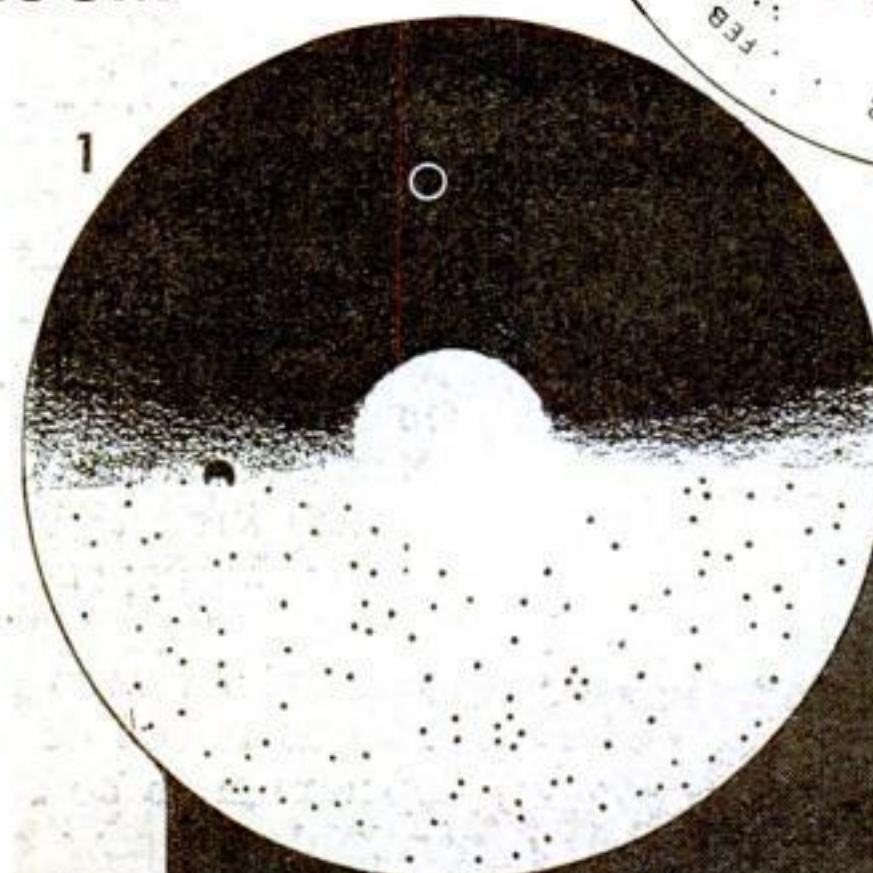
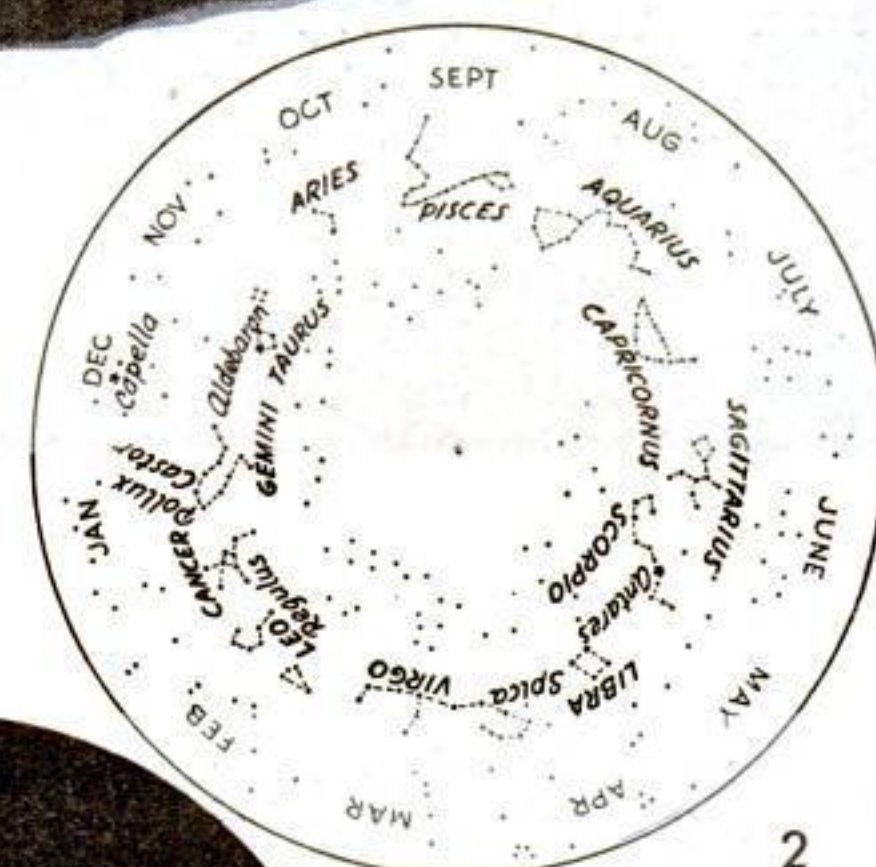
and how to use the Big Dipper in telling time as both a clock and a calendar.

The images of the night sky are projected on a screen or a light-colored wall from special lantern slides that you can produce photographically, and making these should be the first step in constructing the lilliputian planetarium.

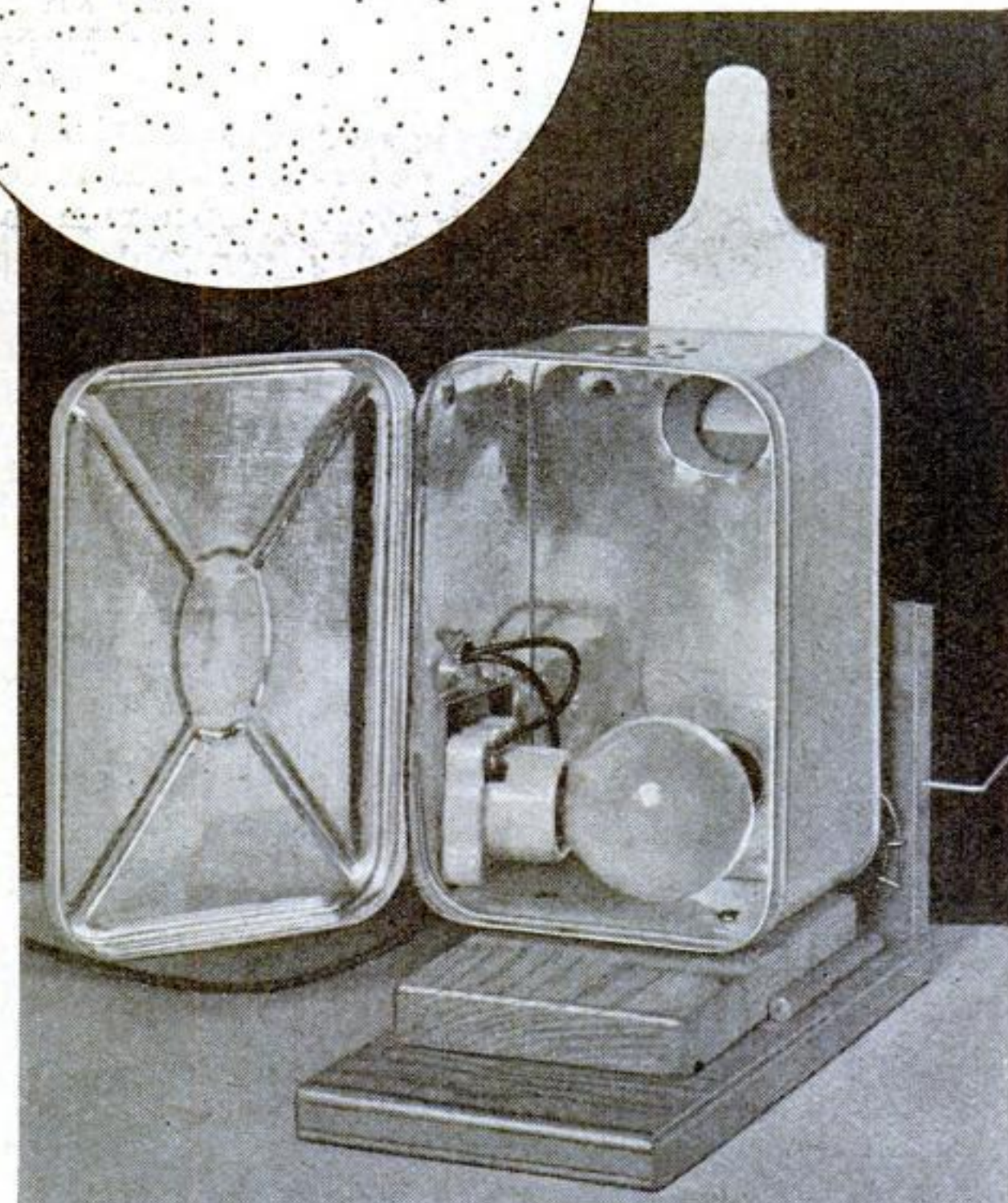
The slides consist of celluloid camera-film negatives glued between one-inch microscope cover glasses. To make them, you will need a camera capable of photographing the circular drawings that accompany this article one-half full size. The films, when developed, will show white lines on a black field, and this is exactly what is desired for projecting pictures of bright stars on a dark sky.

The best kind of camera to use for this purpose is the kind with a ground-glass focusing back, and a long bellows extension. However, with one or two improvisations, you can use an ordinary roll-film camera.

Set the camera up on a



Star images are projected from slides made by photographing these circular star drawings



Mounted in an improvised housing made from a tin lunch box, a low-wattage electric bulb gives ample illumination

rigid tripod or other stand so you can make adjustments without disturbing its position, then stretch a piece of thin tissue or tracing paper in the position normally occupied by the film. With an ordinary camera you will not be able to focus closely enough to get a one-inch image, so tape a reading glass, or other inexpensive magnifying lens, in front of the regular camera lens. This will act as a powerful portrait attachment. Adjust the bellows and move the black-and-white star drawings nearer to or farther from the camera until you get a sharp, one-inch image, then remove the tissue paper, insert a film, and photograph the set of drawings.

It is advisable to use ordinary "color-blind" film rather than panchromatic, because the black-and-white image then will be more contrasty. The ideal negative material is the so-called process cut film; it will give clear, black-and-white star maps. However, you will not be able to use it unless you have a camera equipped with plate holders. In photographing, it is well to cover up everything in front of the lens except the star map itself with black cloth to keep stray light out of the camera, where it would tend to fog the image.

It is not necessary to make the slides exactly one inch in diameter. This dimension is suggested because it is the largest size in which circular cover glasses are readily available. If you

cannot get these circular covers, use square pieces of thin glass, and make your film negatives to suit. You will then have to alter the projection apparatus to fit the square slides.

The planetarium apparatus, which rotates the circular slides and projects the pictures upon a white sheet, is in two parts—the slide rotator and the lamp house. The slide rotator can be built easily, as shown in the detailed construction diagram, from two pieces of plywood and a piece of wooden curtain pole.

The curtain pole is bored lengthwise with a one-inch auger, and smoothed up into a hollow cylinder with a rat-tail file and sandpaper. The disk is sawed out of quarter-inch plywood. Its center hole is fitted to the end of the hollow cylinder and glued in place.

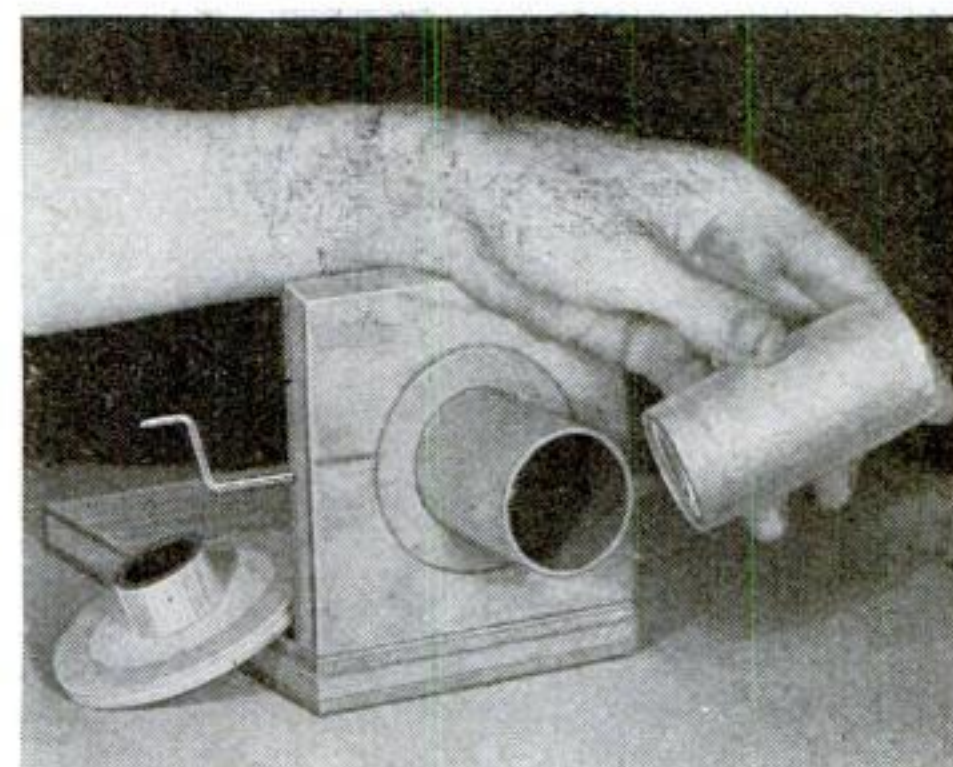
The cylinder then is arranged to rotate very easily and smoothly in a felt-lined hole bored through the upright board. The driving crank is built as illustrated. It turns a small wood cylinder covered with a bit of rubber tubing, and this engages a flat ring of fine sandpaper glued to the back of the disk.

A spring made of hard brass wire keeps the slide carrier in contact with the rubber-covered cylinder on the driving crank. It also insures contact with three smooth nail heads, which act as bearings for the disk.

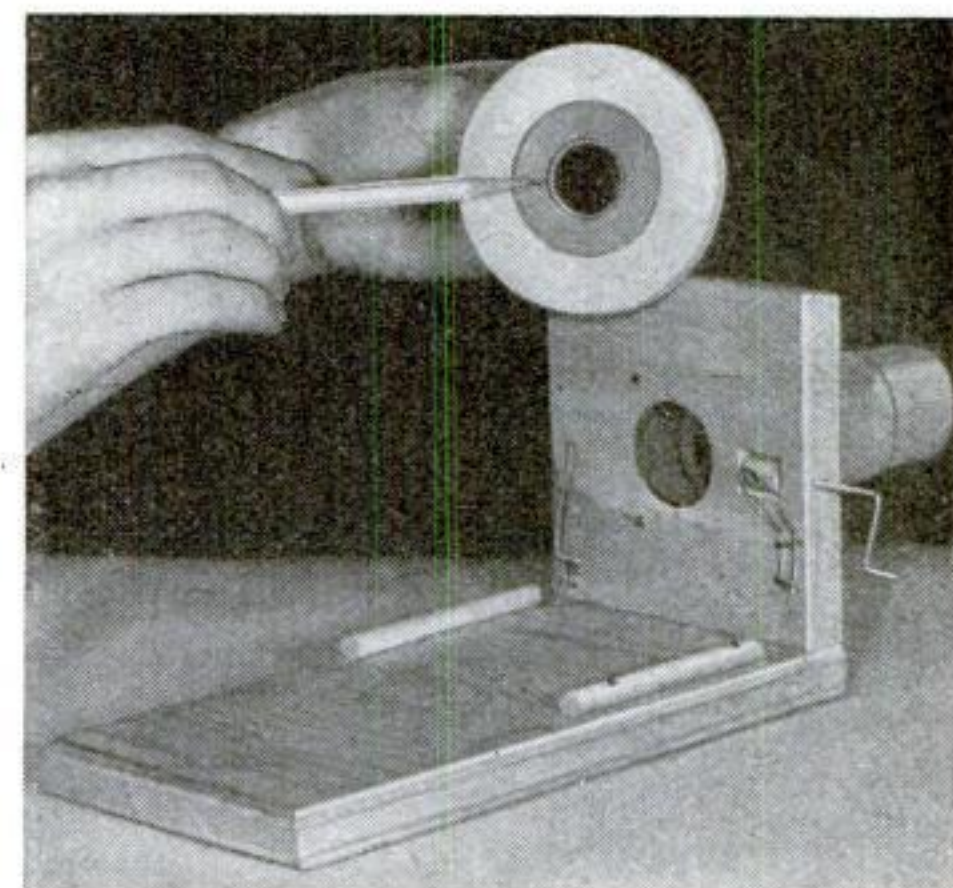
The construction of the lamp house

offers no difficulty. I used a child's lunch box bought for twenty cents. A porcelain lamp socket was mounted inside, and supplied with an ordinary frosted thirty-watt bulb. You can, of course, solder up a complete lamp house from tin or sheet brass, and make it large enough to accommodate a more powerful bulb. A brighter light would enable the apparatus to project a larger picture on the screen.

It is advisable to defer the mounting of the lamp socket in the lamp house until the *(Continued on page 138)*

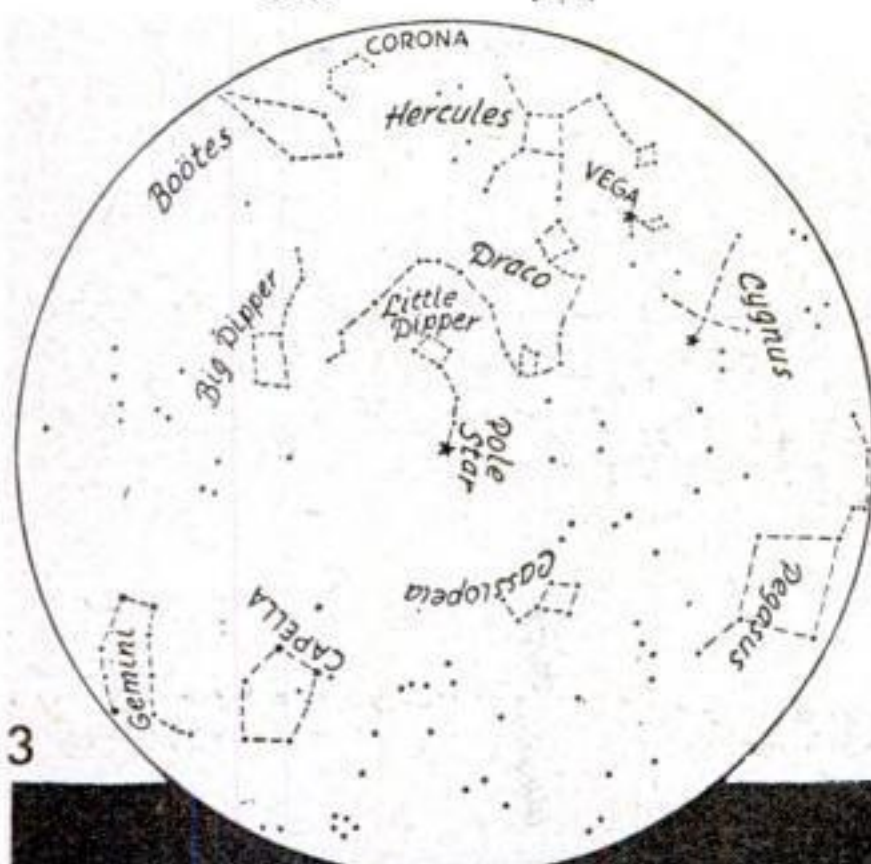
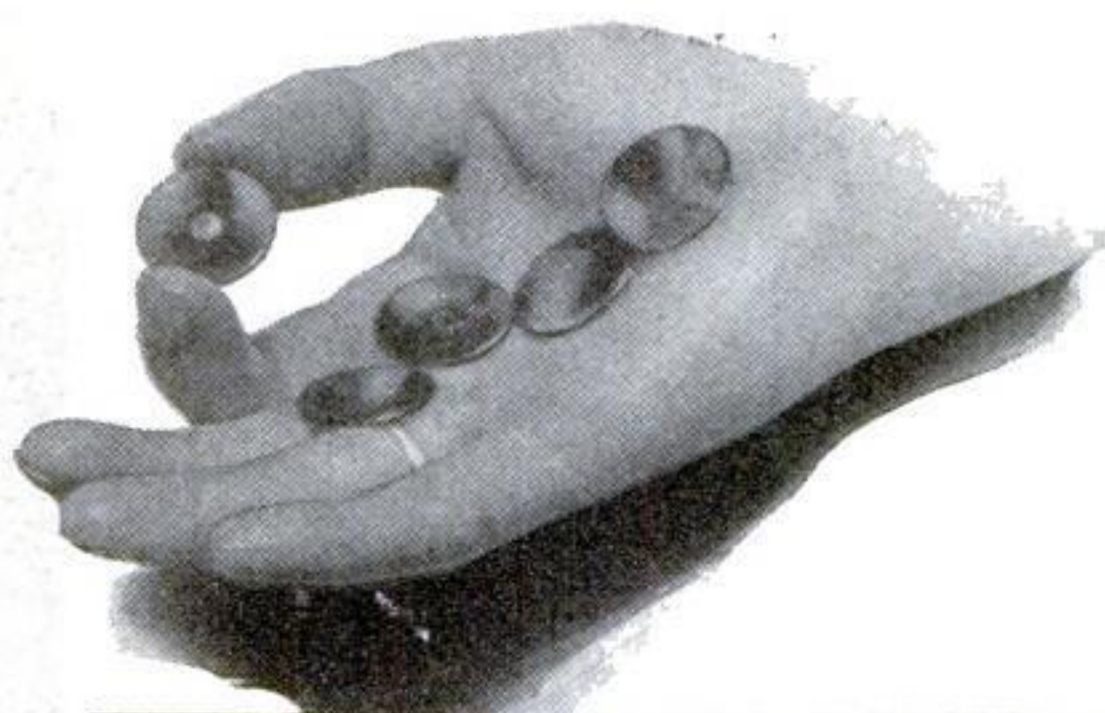


Inexpensive magnifiers glued in a short section of mailing tube form the projection lens

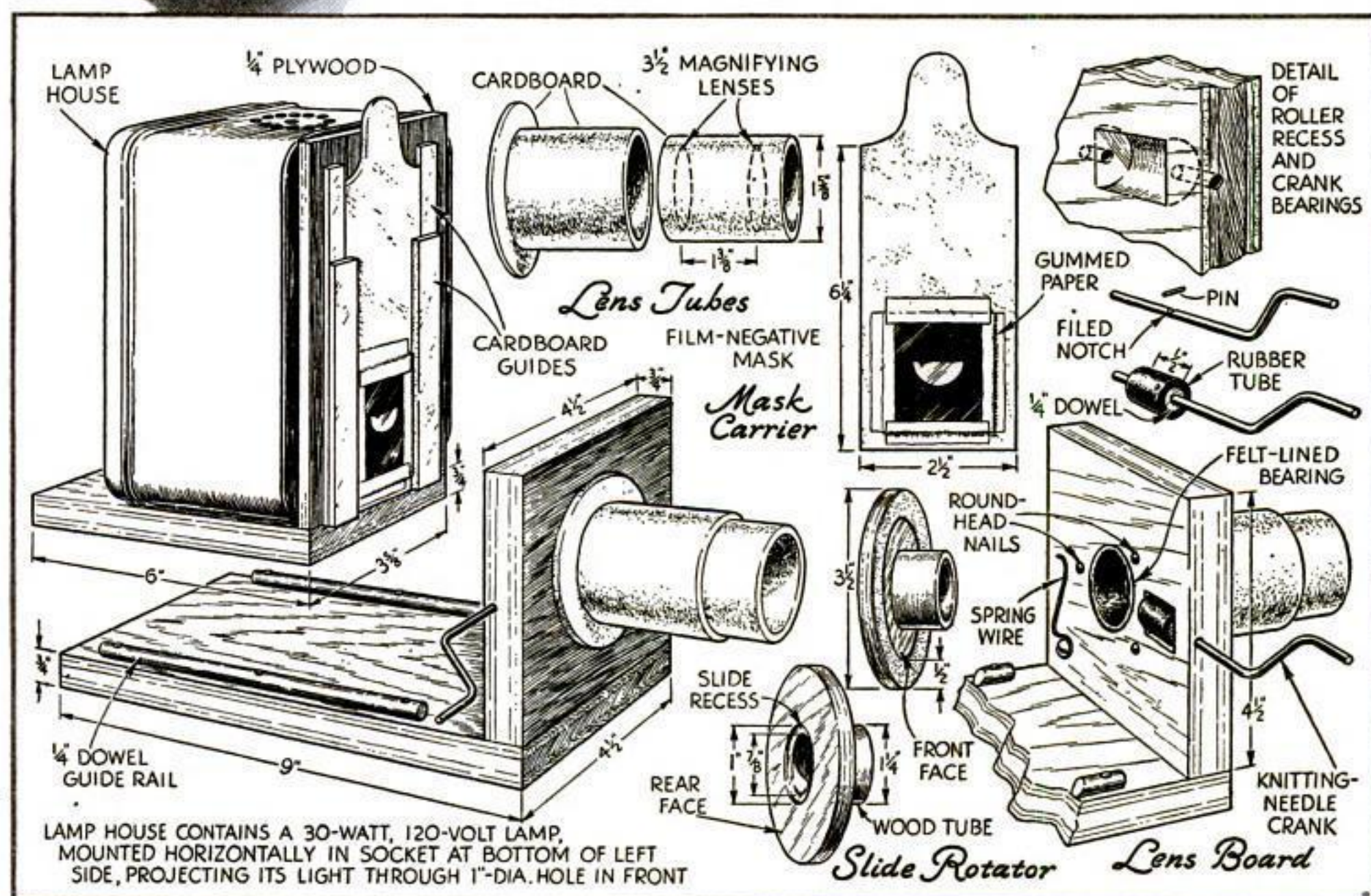
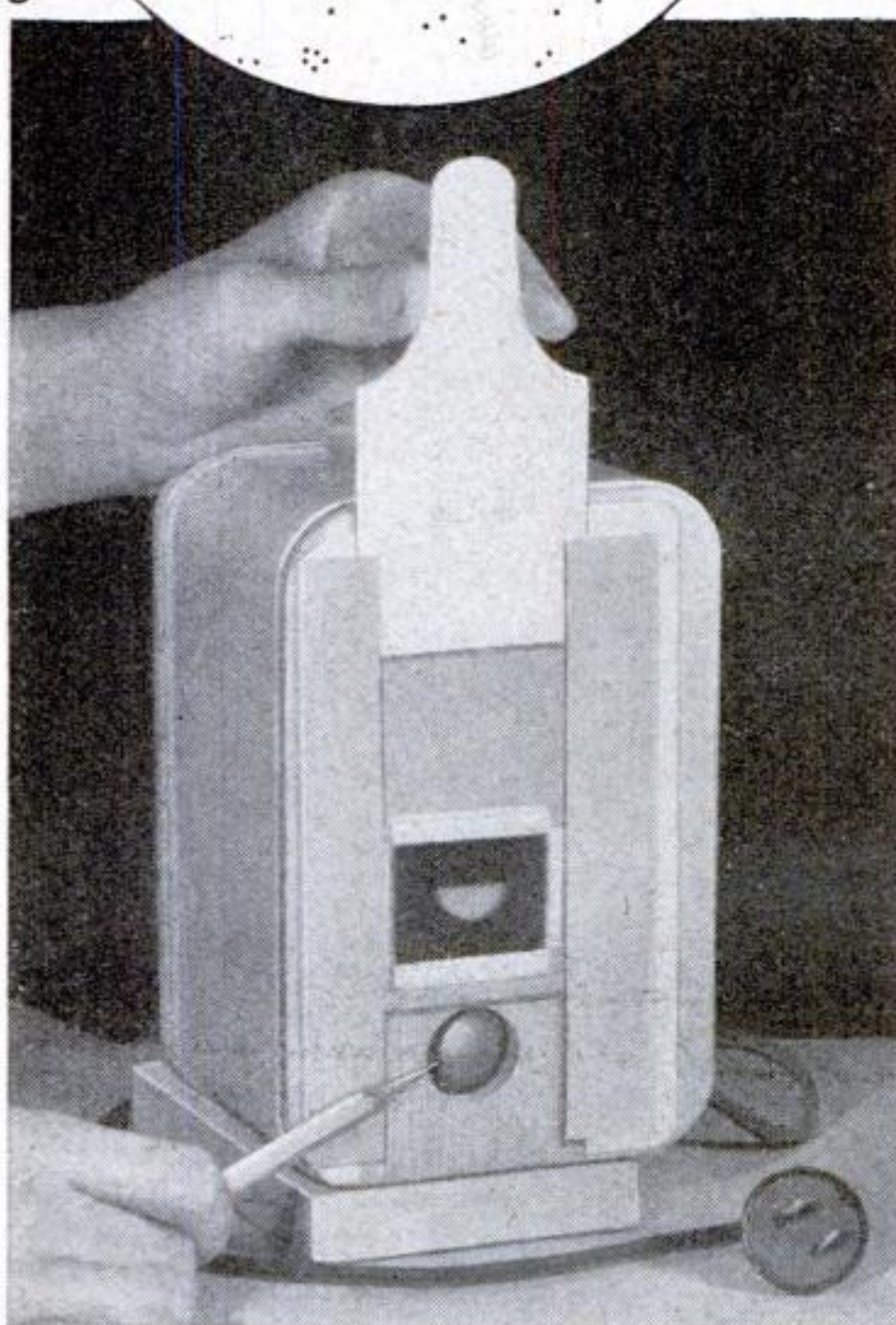


In use, the projection slides are placed in a recess in the rotatable disk above

A whole evening's entertainment can be provided with these five slides. To make them rigid, the circular negatives are mounted on small-diameter, microscope cover glasses



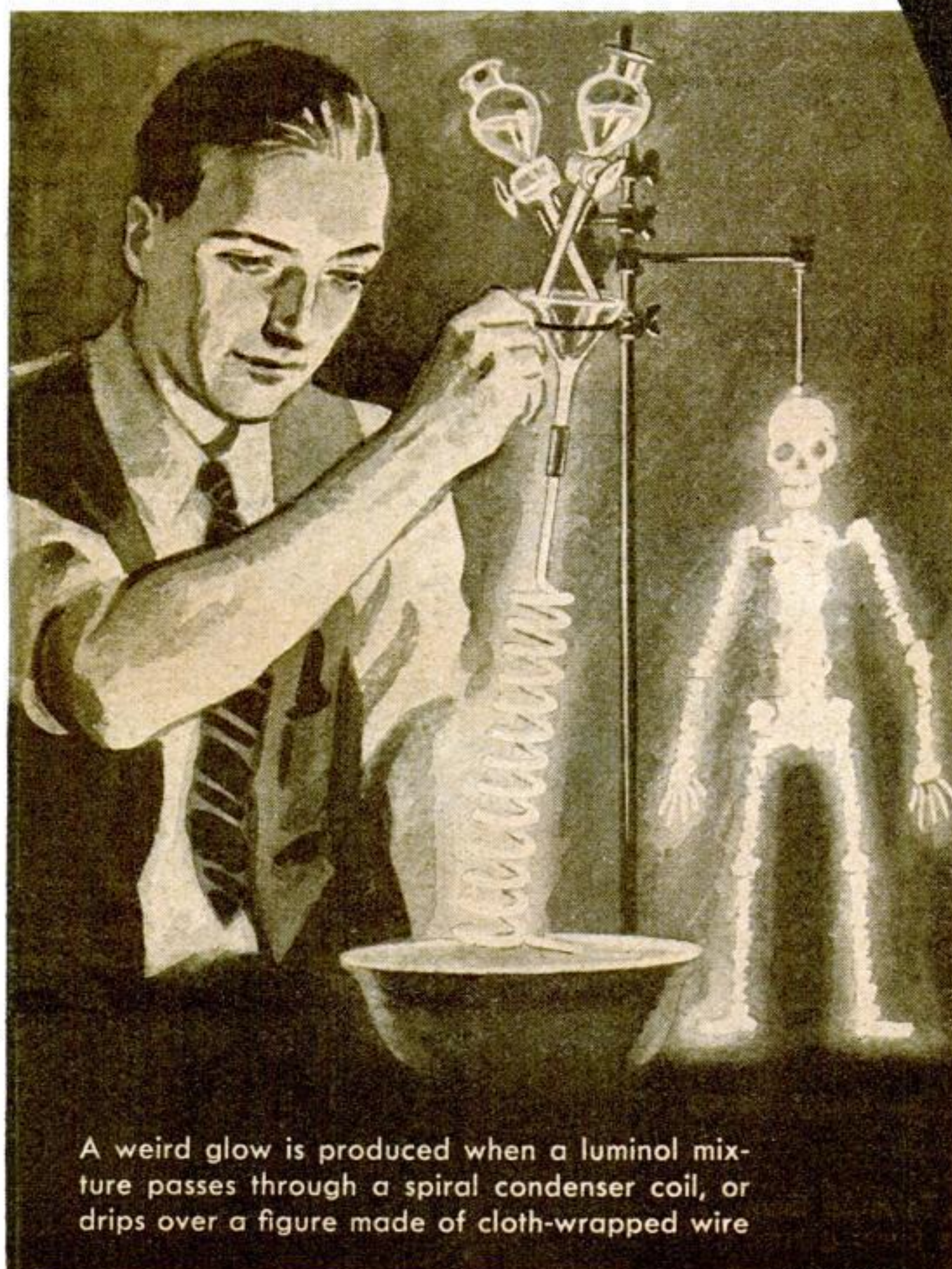
3



Construction details of the parlor planetarium. The general design can be varied, if necessary, to suit the materials and parts you have on hand. The front view of the lamp housing at the left shows the sliding carrier for the horizon mask raised to reveal the light opening

FIREFLY

HOME-LABORATORY



A weird glow is produced when a luminol mixture passes through a spiral condenser coil, or drips over a figure made of cloth-wrapped wire



In experiments with substances other than oil of bergamot, you may need to accustom your eyes to the darkness before performing the experiment, as the light is very faint. However, a strong glow may be obtained from the chili powder which is used in flavoring chili con carne—especially the very hot kind. A single can of chili powder from the grocery store will be enough for innumerable experiments. Steep a little of it in alcohol and add alkali, hydrogen peroxide, and sodium hypochlorite as before. The resulting liquid shines plainly in the dark.

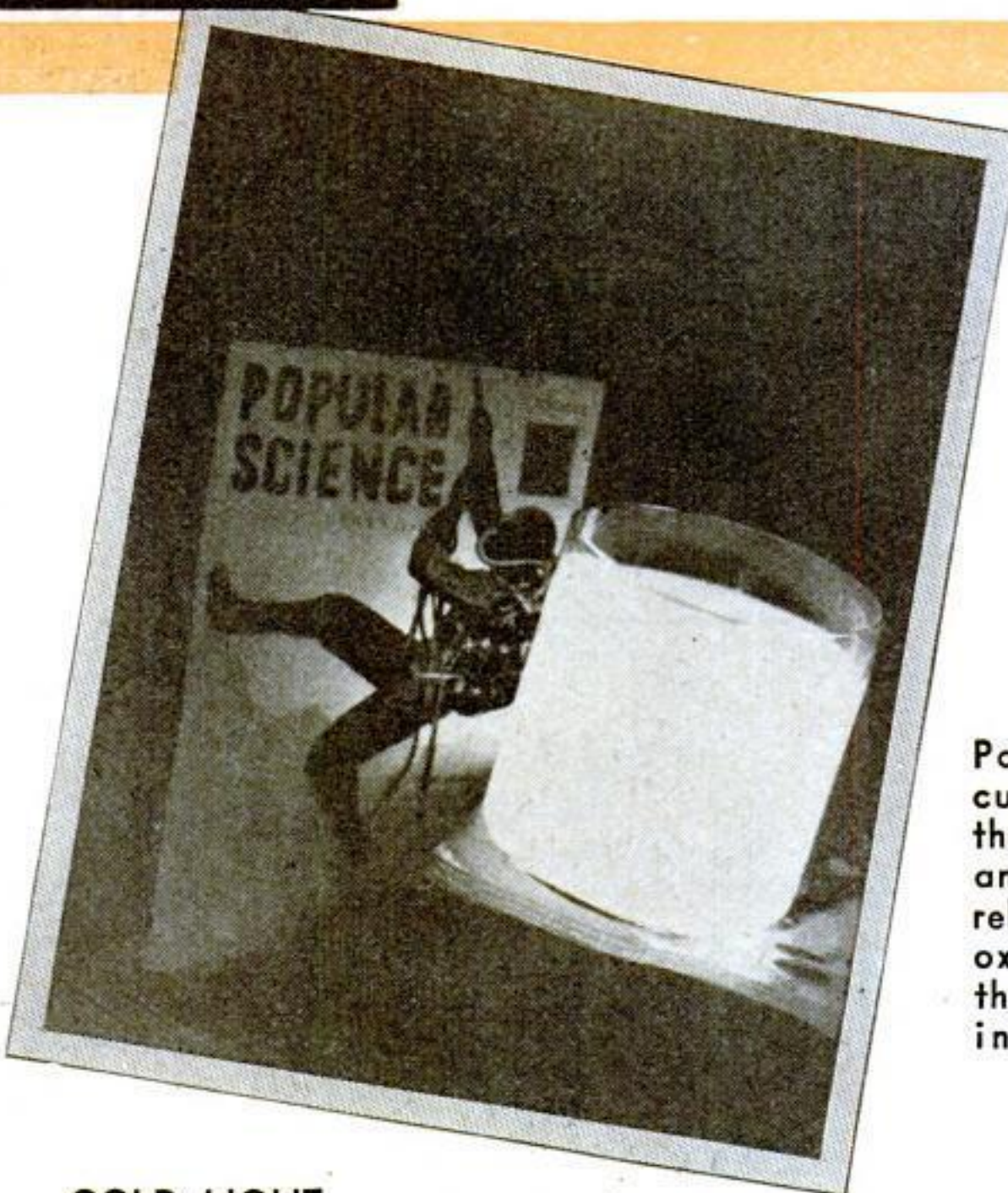
Paprika powder, given the chemical treatment just described, also will glow in a darkened room, as will other spices, condiments, and kitchen staples. You will find it a fascinating pastime to try out a little of everything on the pantry shelf, to see what substance will give the strongest light. Grass, leaves, and flowers also can be used in your experiments if you macerate or grind them with the alcohol to extract the active constituents. Sometimes, in the case of flowers, the alkali will help to extract the glow-producing substance if it is added to the alcohol before soaking the plant. Instead of the liquid clothes whitener, an antiseptic solution found in many home medicine chests, technically known as a modified Carrel-Dakin solution, may be employed as an alternative source of sodium hypochlorite.

Now you will be interested to make the acquaintance of the ideal luminous material—a chemical produced by recent research,

AMONG the most mysterious and beautiful of chemical experiments are those producing substances that glow in the dark. With the aid of your home laboratory, you can make any number of common household products self-luminous. Coffee, tea, pepper, chili powder, mustard, cocoa, ginger, and many other groceries will produce a really visible light in a dark room, after you have treated them with the proper chemicals. You may even be able to make a flower from your garden emit enough illumination to allow you to read a few letters of print, and you will find that oil of bergamot, an ingredient of inexpensive perfumes, gives an especially strong glow.

All that you will need to produce these strange effects is a little grain or denatured alcohol, a common alkali such as lye, hydrogen peroxide from the drug store, and one of the newer, "made with electricity" bleaching liquids and laundry whiteners. There are several of these liquids, widely advertised and obtainable at any grocery store. They are solutions of sodium hypochlorite, and you will find that this statement appears on the labels of the bottles.

Suppose you start in by purchasing about an ounce of oil of bergamot at the drug store. Add half a teaspoonful of it to an ounce of grain alcohol, rubbing alcohol, or radiator alcohol. Also dissolve in the liquid several pieces of solid sodium hydroxide (ordinary household lye will do), or potassium hydrox-



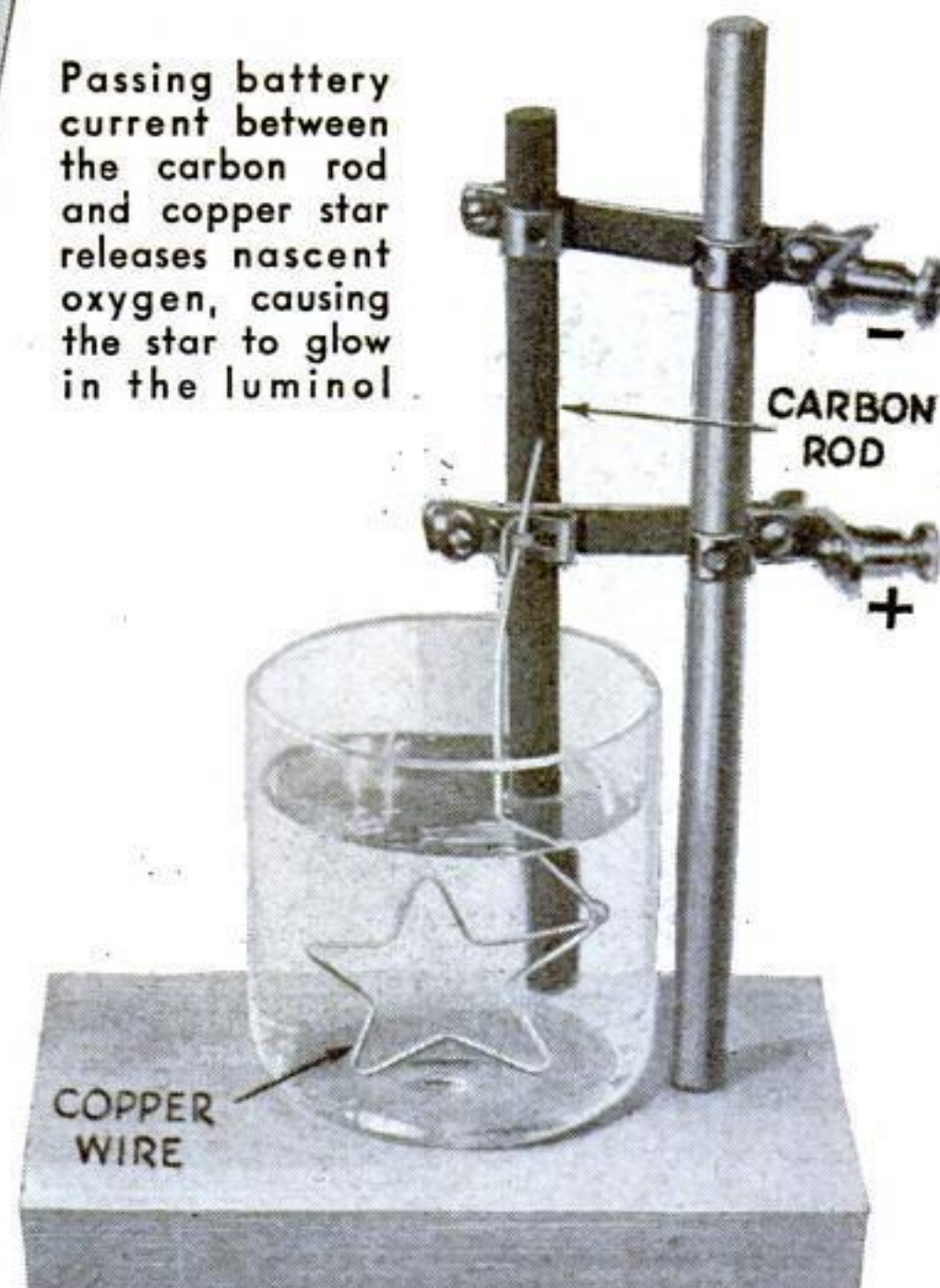
COLD LIGHT

The only light used in taking this picture came from the jar of luminol in foreground

ide. Now add about half a teaspoonful or so of drug-store hydrogen peroxide, and a like amount of the sodium hypochlorite solution. Darken the room, or take the mixture into a dark closet.

You will see light streaming from the liquid—"cold" light, soft and heatless like that of the firefly. Usually the mysterious glow is yellowish-green. Chemiluminescence is the name given to the weird phenomenon.

Passing battery current between the carbon rod and copper star releases nascent oxygen, causing the star to glow in the luminol



CHEMISTRY

STUNTS WITH LUMINOUS SUBSTANCES

capable, under certain conditions, of giving off more cold light than any other substance known. Not only can you read print by its light, but you can even wander about your darkened laboratory by its illumination. Chemists call it "3-aminophthalhydrazide," and it bears the common name of luminol. Many dealers in chemicals can supply it, and sixty cents' worth will provide you with plenty for your experiments. Do not confuse it with luminal, another organic chemical, which is used in sleeping tablets; this is not the material you want.

To perform experiments with luminol, two solutions are made, producing light when they are mixed. One of the accompanying illustrations shows a copy of *POPULAR SCIENCE MONTHLY* photographed by the light of the resulting mixture alone, using a gallon jug of it. To make enough to fill a vessel of this size, proceed as follows:

For the first solution, dissolve about two tenths of a gram of luminol in about an ounce of water, which has previously been made alkaline with a small piece (about the size of a pea) of sodium hydroxide or potassium hydroxide. Ordinary lye may be used for the alkali. When the luminol has dissolved, add about two quarts of water.

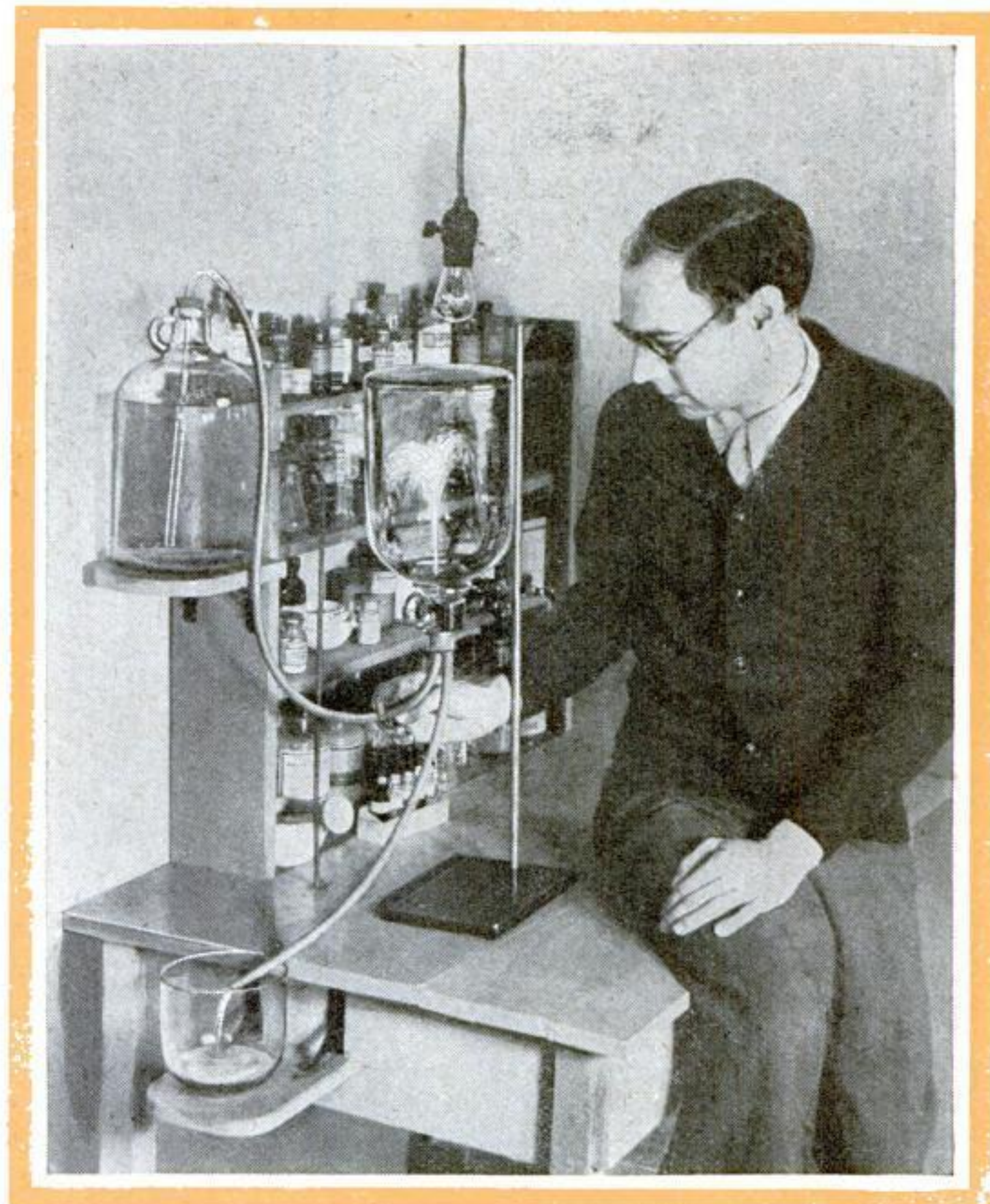
To make the second solution, dissolve half a gram of potassium ferricyanide (also known as red prussiate of potash) in several ounces of water. Then add about an ounce of hydrogen peroxide of drug-store strength (three percent), and dilute with about two quarts of water.

If you do not have facilities for measuring the luminol and the potassium ferricyanide in fractions of a gram, use a piece of each about the size of a pea. A little variation in the proportions used will not matter.

By
Raymond
B.
Wailes

A FOUNTAIN OF GLOWING LIQUID FIRE

Luminol solution, contained in the upper jug, is siphoned off and led to a medicine-dropper nozzle in the inverted jug, where it spurts upward in a glowing fountain of light. The surplus is drained off at bottom.



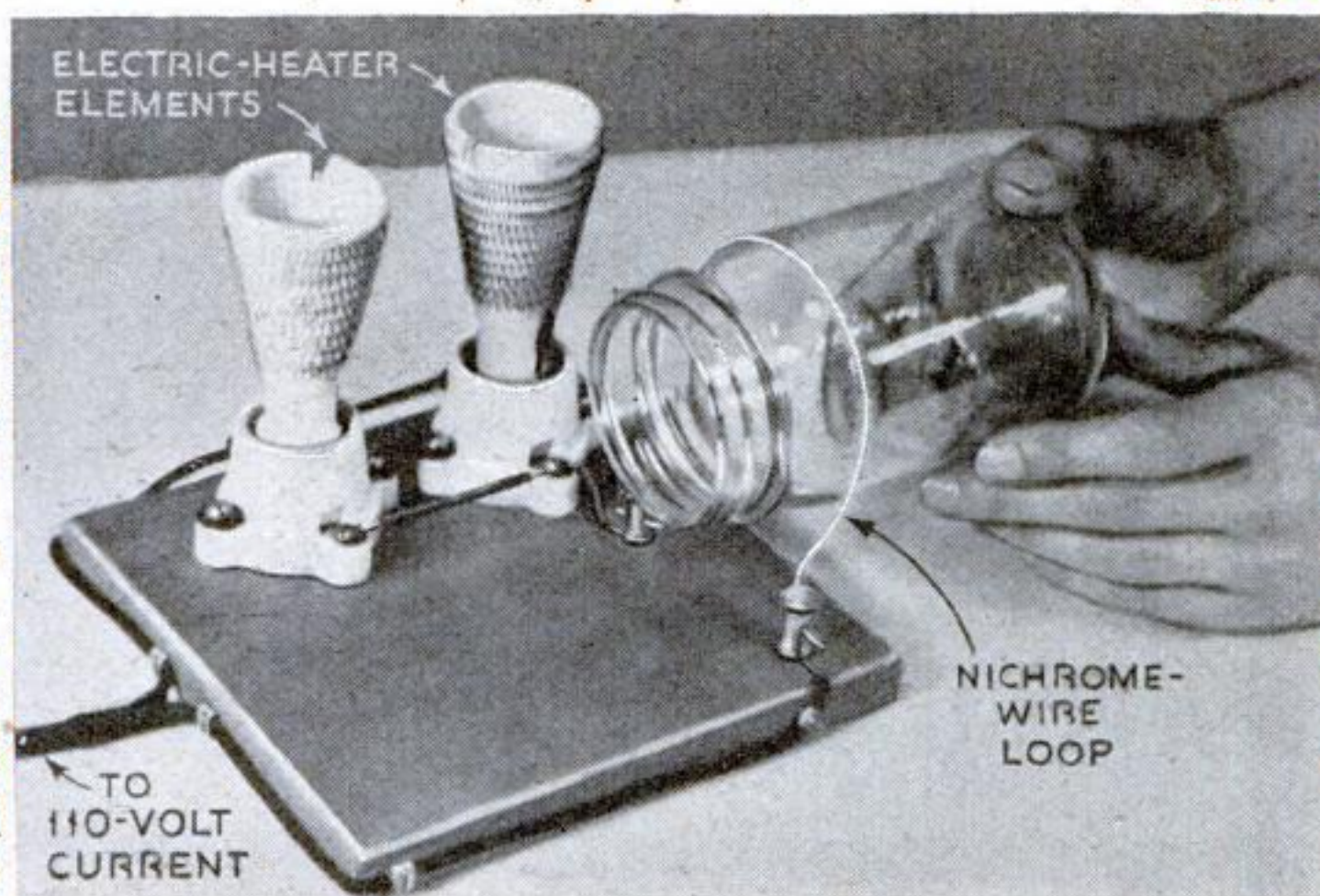
When the first and the second solutions are mixed, bluish-green light streams from them, rivaling the illumination of a ten-watt lamp. The glow lasts for several minutes, slowly dimming as time goes on. To restore its brilliance, however, you need only add more potassium ferricyanide or more alkali, either in solid form or in solution. If you use the solid, the resulting glow is extremely intense near the surface, where the concentration of the newly added chemical is greatest. Stir

the liquid, and it will swirl about to form beautiful luminous clouds.

To enhance the beauty of the display from luminol, try putting some of the luminous mixture in cut-glass vases, many-faceted vinegar cruets, and ornamental perfume bottles. The vessels will glow in the dark as if afire.

Dip a strip of lace or a piece of an old lace curtain in the mixed liquid, and then hang it up in the dark. The startling result, with every line of the pattern outlined in glowing fire, surpasses description.

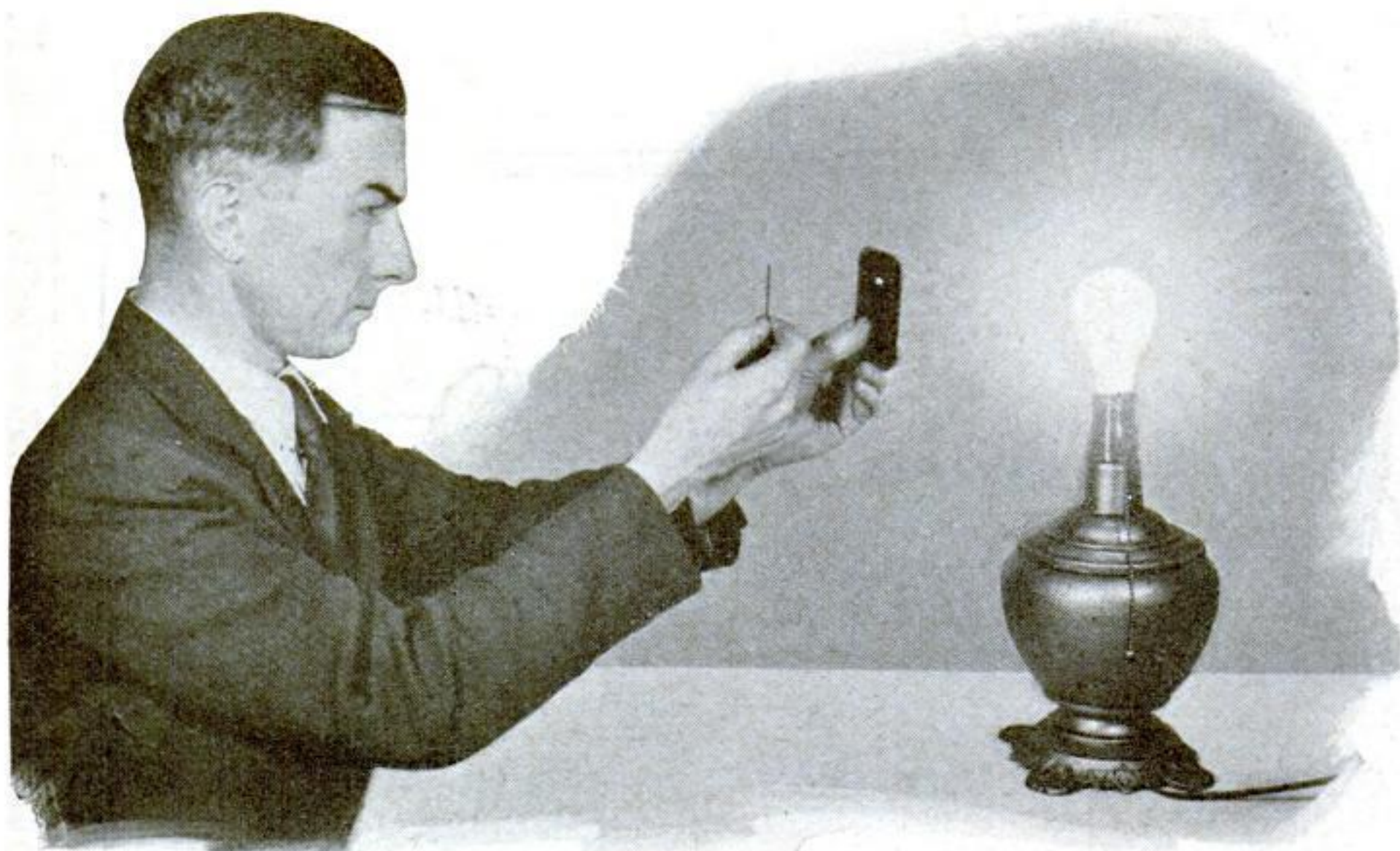
For any display of home magic, luminol offers fascinating possibilities. Flowers in a vase, previously sprayed with one of the two solutions, magically light up as if they were burning when sprayed with the other solution in the dark—and will be found whole and unharmed by the mysterious fire when the lights are turned on again. For another effect that is really startling when it is accompanied by a bit of drama in a darkened room, you can wet your hands with one solution and use a cloth moistened with the other one as a towel. (Be sure to wash your hands carefully to remove the chemicals, when you are through.) Weird and fantastic decorations for a magical seance can be made by winding cloth tape around stiff wire bent to represent thunderbolts, (Continued on page 144)



CUTTING JARS WITH A HEATED WIRE

Glass beakers can be made by cutting off the tops of jars and bottles by holding them against the loop of hot nichrome wire. A mark is filed around the bottle at the place it is to be divided

HOME TESTS TO PROVE Scientific Facts



Experiment Makes Light Turn a Corner

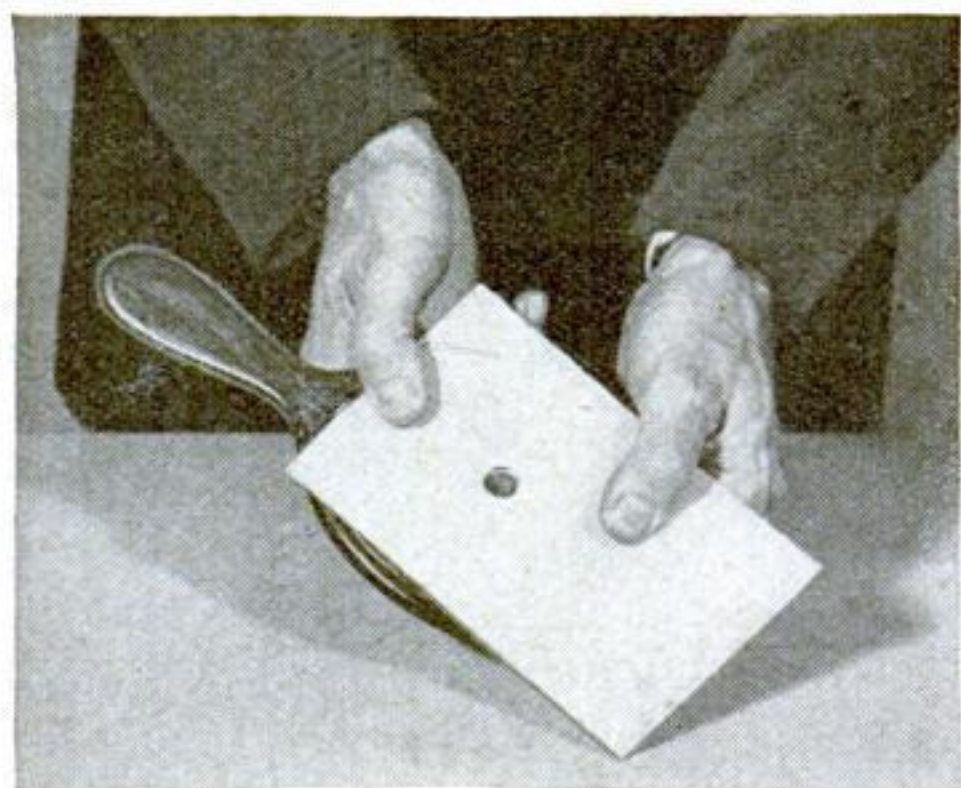
WITH a piece of tin or cardboard pierced with a small hole, and a length of wire whose diameter is greater than that of the hole you can easily show how light can travel around corners. Hold the wire and

hole so they are in line with your eye and a lamp, and you will apparently see the hole right through the wire. Actually the light is bent around the metal by a process called diffraction.



Heat of Candle Flame Makes Air Conduct Electricity

TO DEMONSTRATE how tiny electric particles liberated from a flame make air a conductor of electricity, electrify two strips of dry paper by drawing them between the fingers. They will repel each other, but if you bring them near a candle flame, the strips will fall together as the charge leaks off. Shield off the flame with wire screening, and the strips will remain apart.



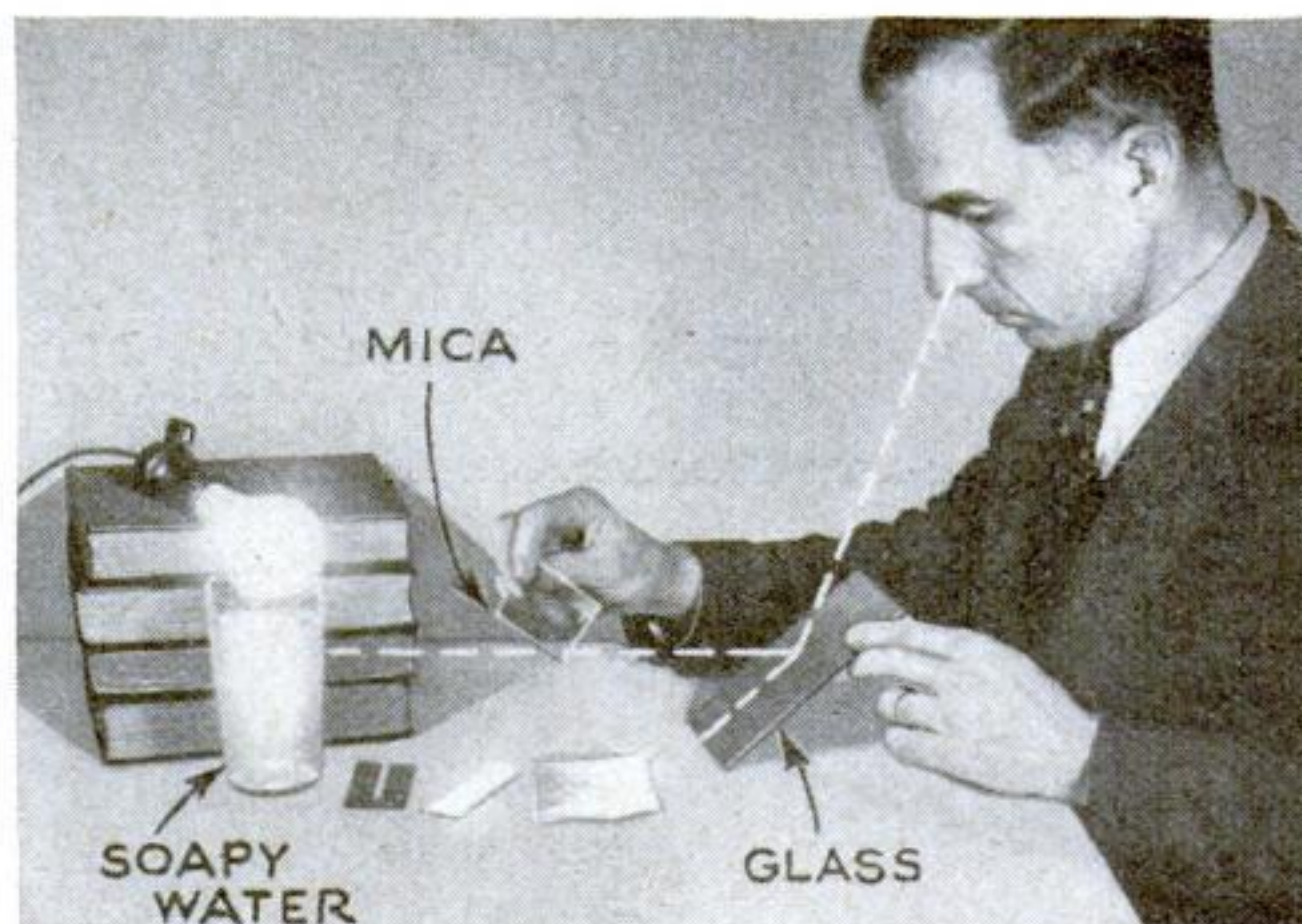
Mirror and Cardboard Mask Aid in Viewing the Sun

HERE is a device for viewing the sun or an eclipse that is better than the usual piece of smoked glass. Cut a hole in a sheet of cardboard, place this over a mirror, as shown, and reflect the image of the sun on a wall or the shady side of a house. If you are viewing an eclipse, you will see an image like that at the right, as the moon covers the solar disk. The size of the hole in the cardboard depends on the distance you wish to project the image. By this method you can show the course of an eclipse on an inside wall, to people who remain in the house.



Soapy Water Produces Polarized Light

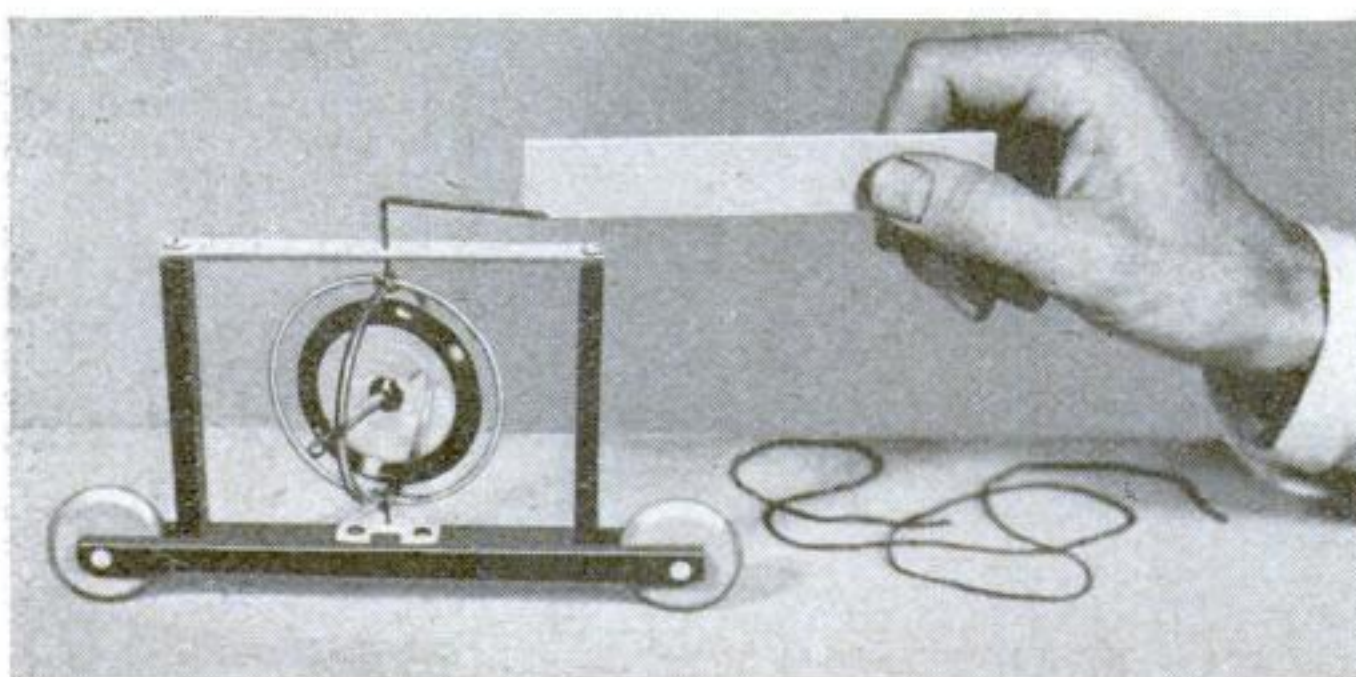
SHINE a light down through a tumblerful of water to which enough soap has been added to give it a bluish color. The diffused light that comes from it is polarized, as you can prove by holding a pane of glass at an angle of thirty-three degrees, as shown, and interposing a piece of mica or transparent wrapping material. Various colors will be produced as you change the position of the cellulose.

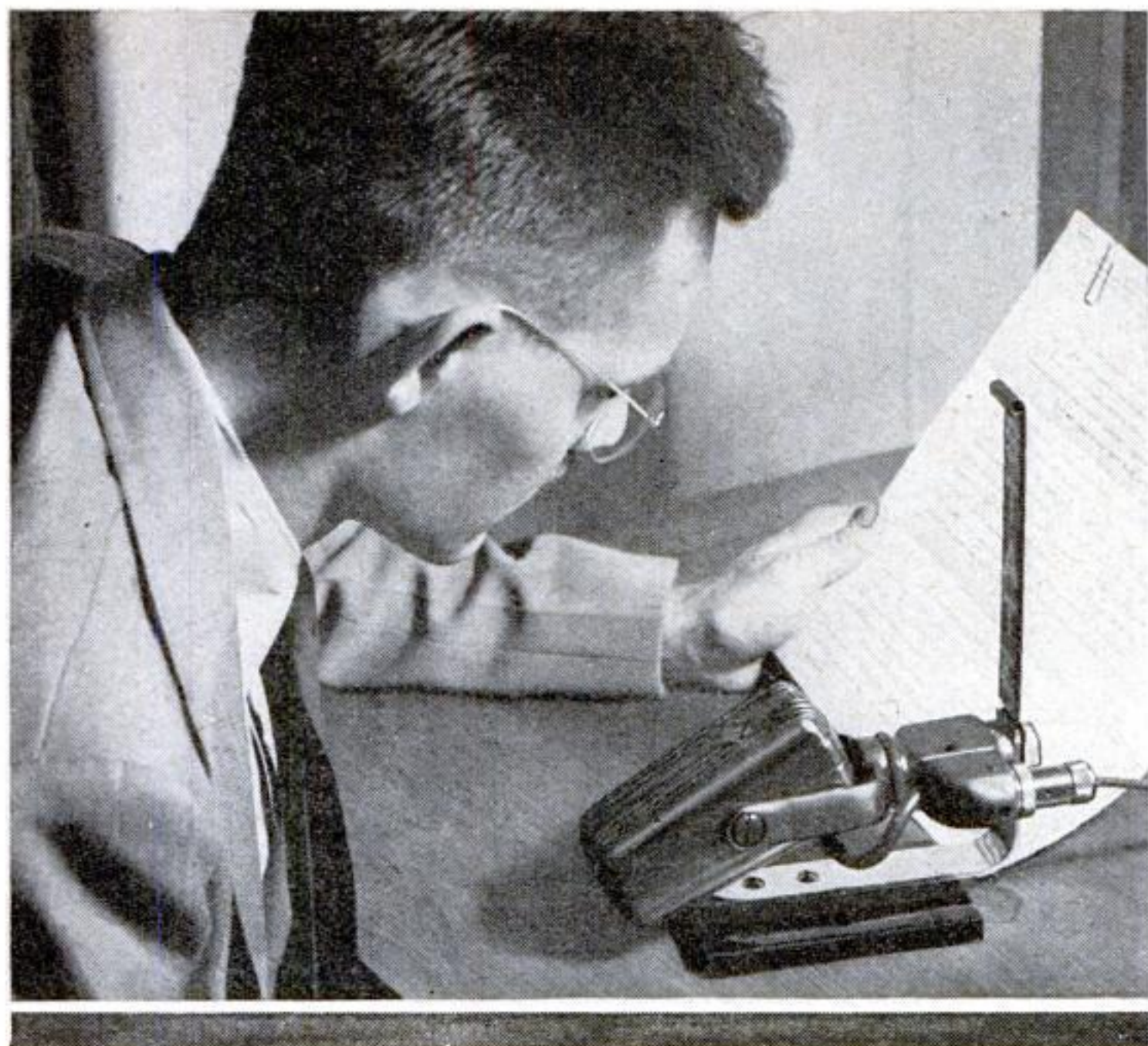


Model Demonstrates Action of Gyro-Car

How A gyroscope is used to balance a monorail car can be shown by mounting a toy gyro-top as illustrated. With

its wheel spinning, the gyroscope will hold the midget car upright as long as the rotor spindle is at right angles to the car's axis. However, the gyroscope will tend to turn slowly and upset the balance. To prevent this, give it a slight push in the direction of the motion. This will reverse the rotation and keep the car upright. On large monorail cars, this reversing is done automatically.





The microphone can be swung to any angle to suit the speaker's position

Useful Ideas FOR Radio Fans

Desk Microphone Rests on Spring

SUPPORTED on a small, heavy base that gives it an unusually low center of gravity, a new microphone is intended for use on desks, pulpits, speakers' stands, and other places where a floor stand would not be suitable. The head can be swiveled at any angle to pick up a speaker's voice. A spring-steel bracket supports the unit and absorbs vibration.

Phonograph Pick-Up Unit Has Offset Head

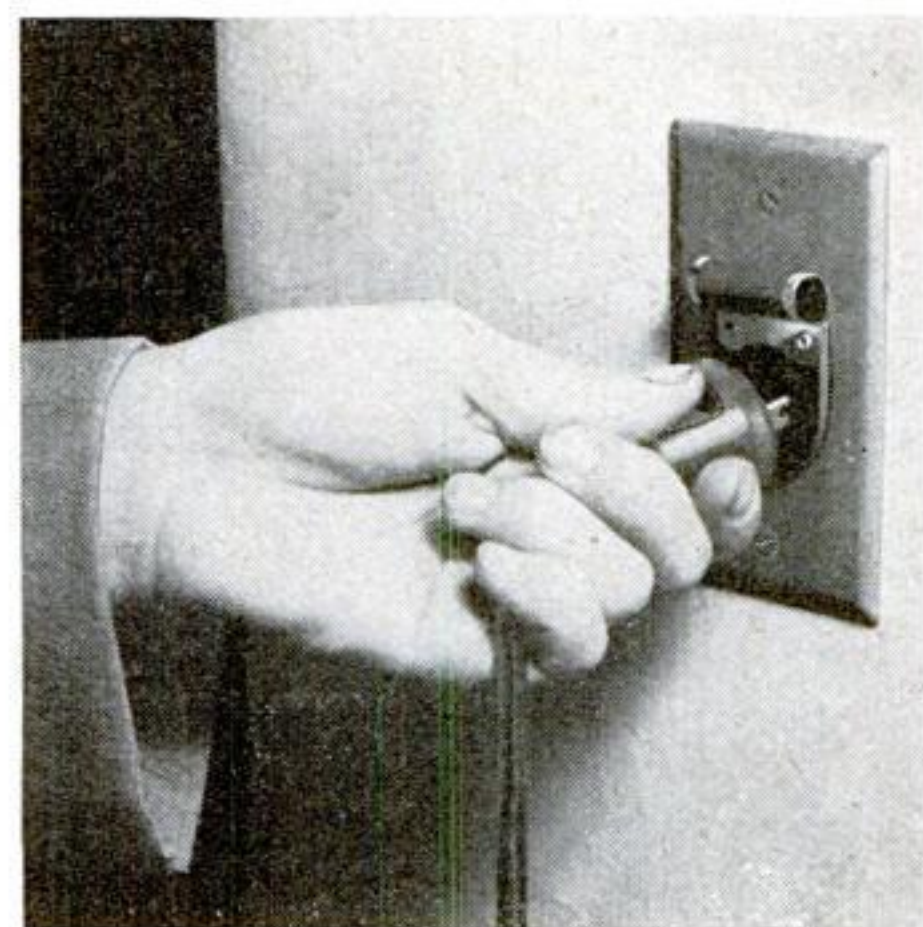
BUILT with its recording head set at an angle, a new phonograph pick-up unit holds the needle parallel to the grooves in a record, thus eliminating excess groove wear. The head also swivels to permit insertion of needles from above, where the operation is in full view.



The offset head of this pick-up unit pivots so that new needles can be put in it from above

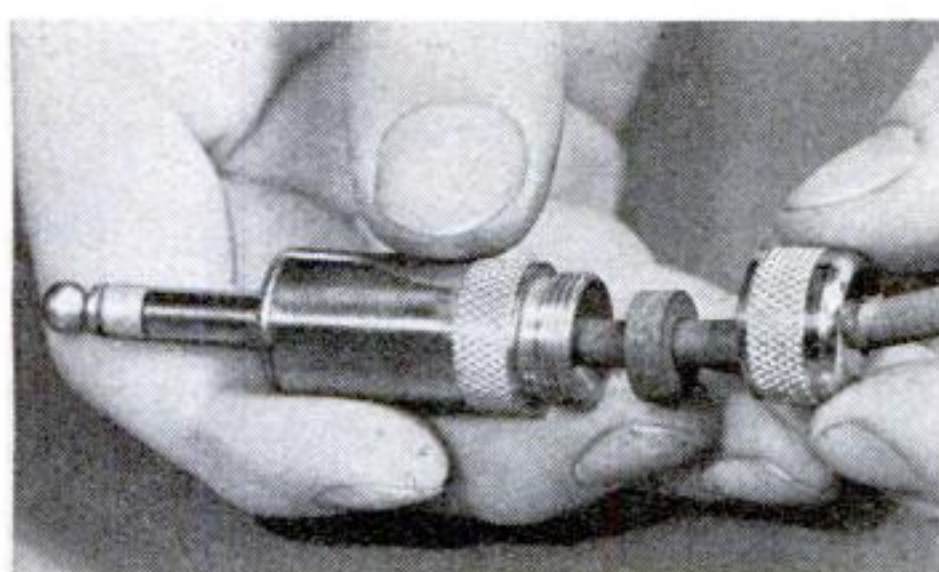
Volume Control Is Operated by Foot

A NEW volume control for public-address microphones is operated by a foot pedal. The control is designed especially for use with pick-ups inserted in violins and other musical instruments, and enables the musician to vary the intensity of the sound as he plays, to produce unusual effects.



New Noise Suppressor Fits Appliance Plug

MAN-MADE static is eliminated right at its source by a compact unit intended for fans, mixers, and other electrical units. It slips over the prongs of the appliance plug and serves to completely filter out troublesome spark interference.



Gasket Keeps Moisture From Microphone Plug

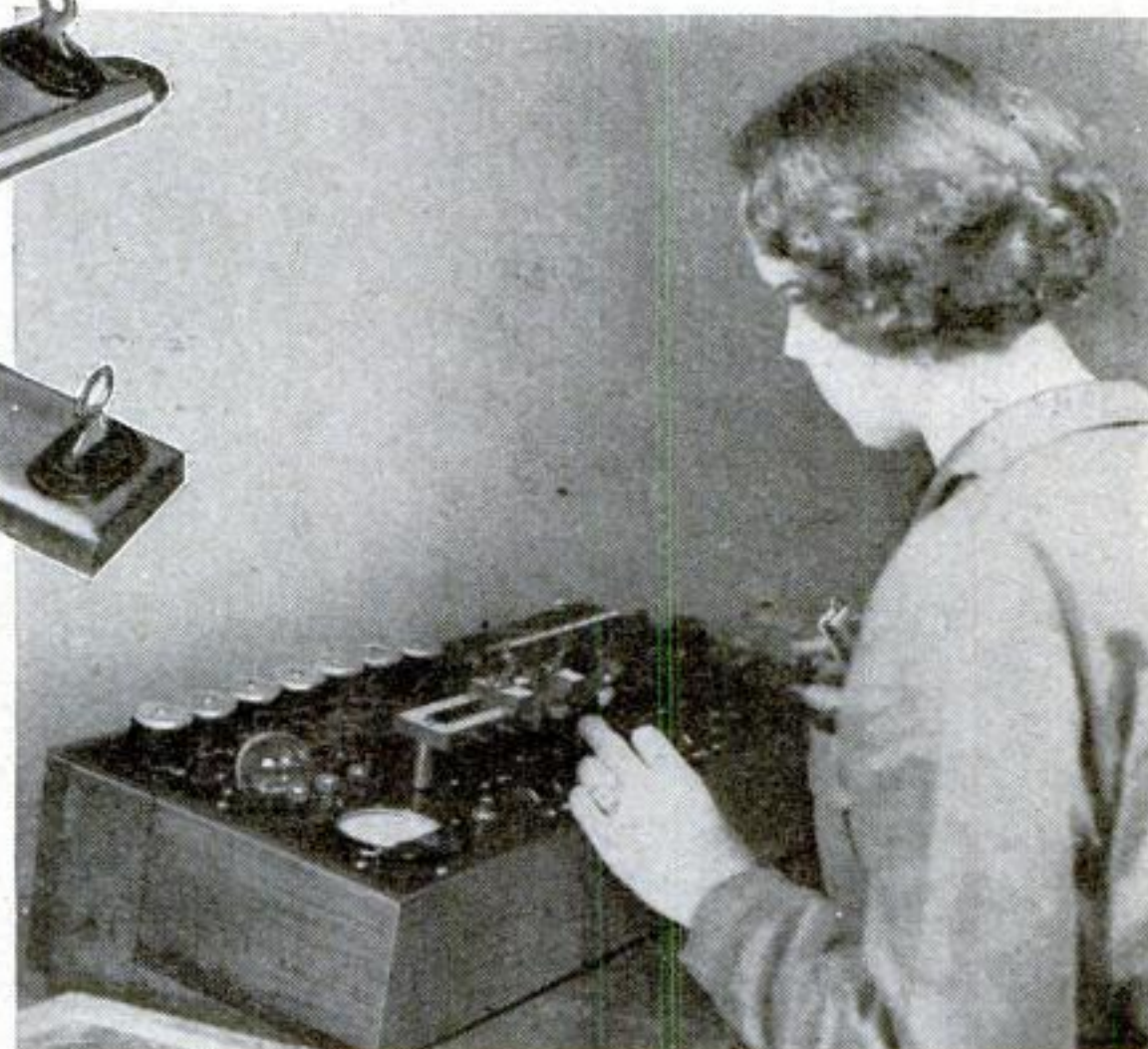
CONNECTIONS to the microphone of an amateur transmitter or a public-address system are sealed tightly by a new plug that is equipped with an ingenious rubber gasket. When the plug parts are screwed together, the rubber gasket is compressed tightly around the cable to form a moistureproof joint.

Large Resistors Assembled from Small Units

Resistors are assembled on a channel strip to make a voltage divider



PRECISION-WOUND resistor units now are available to amateurs in a form that makes it easy to assemble large resistances or voltage dividers to any required value. The resistor units slide into a metal channel strip that holds them firmly together, and may be connected in series, or individually, as needed.



Delicate instruments check each resistor as it is made

In spite of its size, this transmitter gives results rivaling many larger sets

Mighty Midget

COSTS LITTLE TO BUILD

By
**DONALD
LEVENSON,
W8PIN**



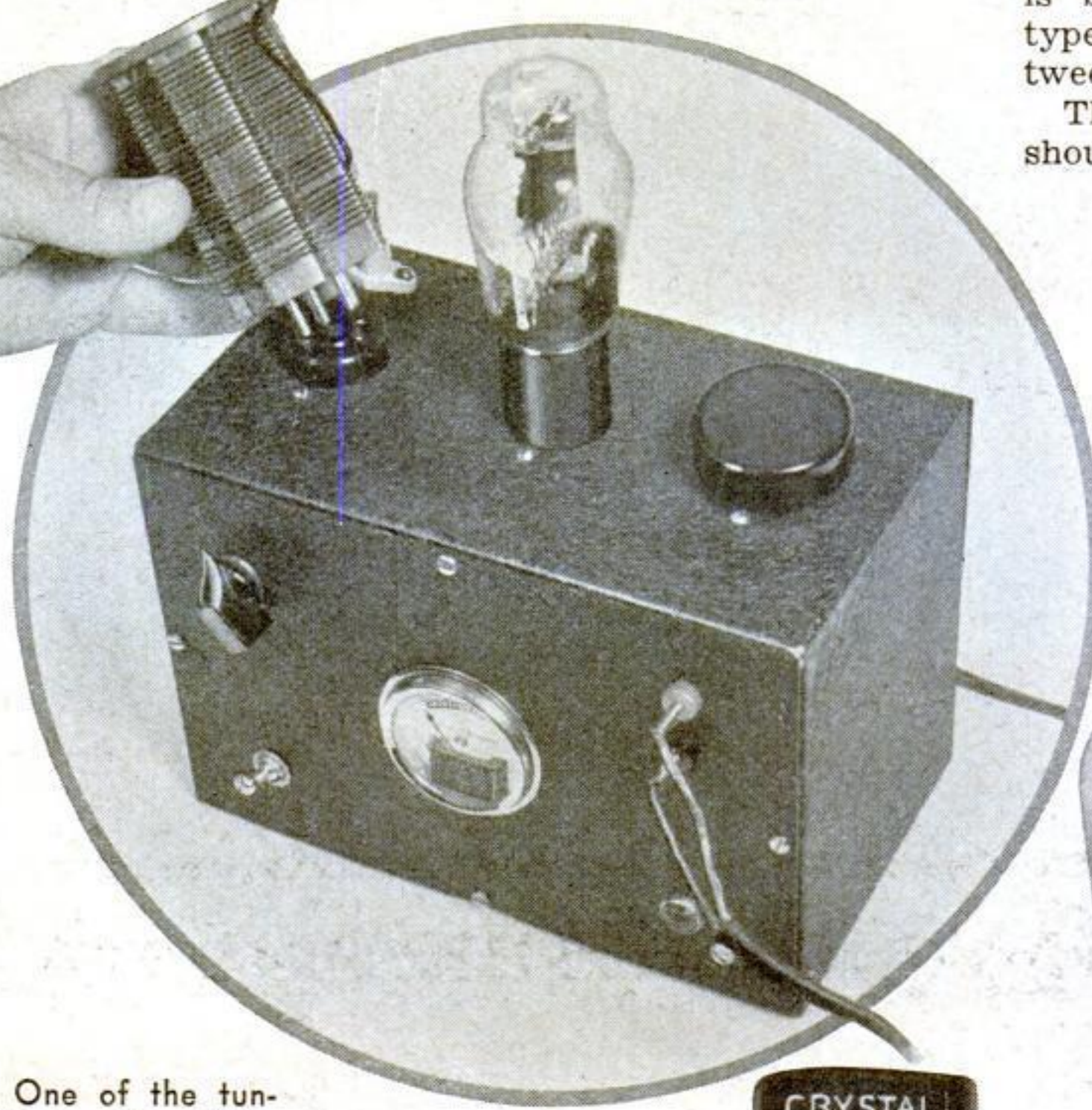
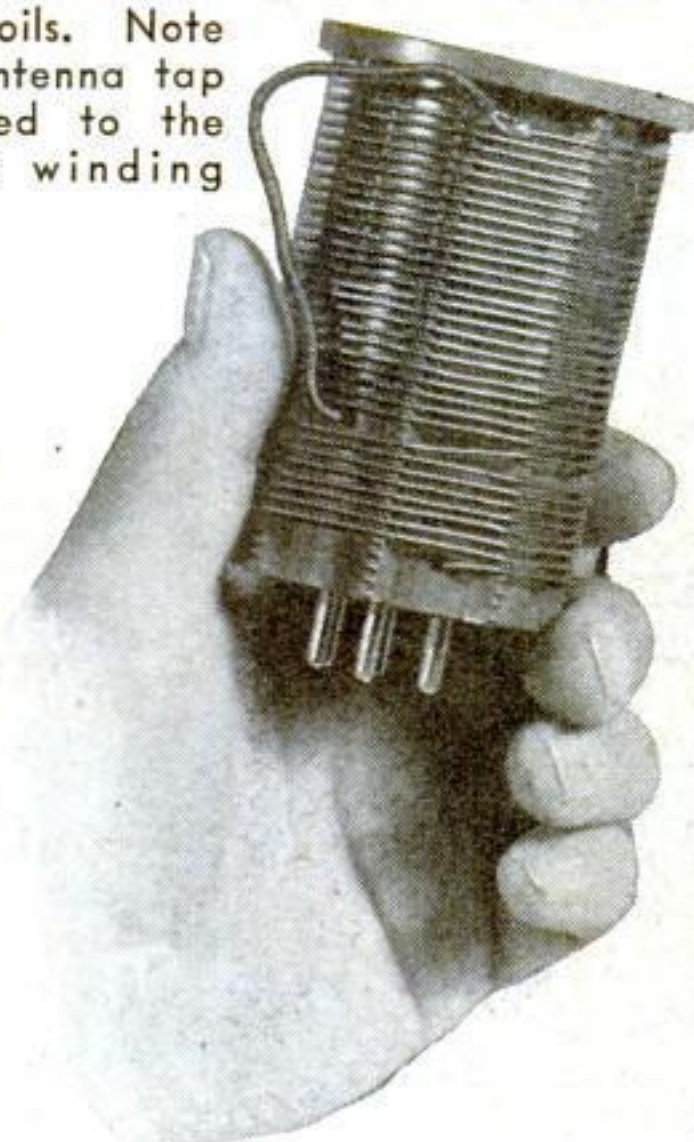
For convenience in wiring and operation, the crystal, coil, and tube are mounted on top of the metal cabinet

FOR the radio amateur who wants an inexpensive, easy-to-build, yet efficient, transmitter, the compact all-electric outfit illustrated offers a maximum of power and convenience at a minimum of cost. Although it consists of only ten parts, exclusive of the power supply, the crystal-controlled circuit has spanned more than 500 miles in tests, providing quality rivaling that of many larger and more costly rigs.

The wiring and general construction of the set are particularly simple. As shown in the wiring diagram, two tubes—a '47 pentode and an '80—are used. The former serves as the oscillator, while the latter provides rectification for the power supply. With the exception of the plug-in coils, which are easily wound, the parts all are standard and readily obtainable.

Because the outfit was designed primarily for portable use, the circuit was housed in a 5 by 6 by 9-inch, crackle-finish metal cabinet. To do this, however, it was necessary to mount the sockets for the '47 tube, the control crystal, and the coil on the top edge

One of the tuning coils. Note the antenna tap soldered to the large winding



of the cabinet. This not only greatly simplified the wiring and soldering operations, but made it possible to devote the entire inside of the cabinet to the tuning condenser, small condensers and resistors, and the power supply.

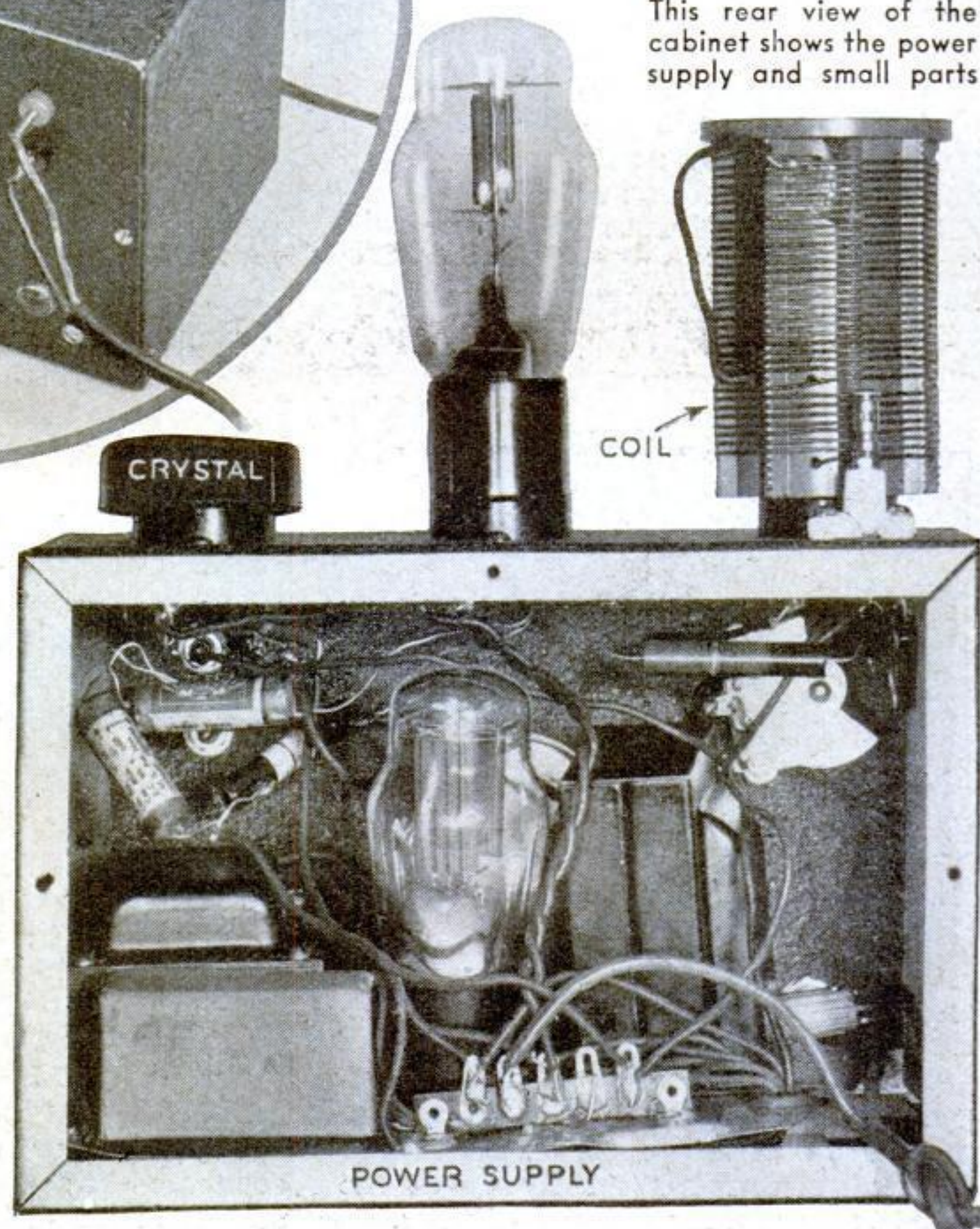
As shown in the photographs, the condenser, the power switch, two terminals for the key, a pilot light, and a 0-100 milliammeter are mounted on the front panel. The meter, used to indicate the plate current and thus the relative output of the circuit, and the pilot light can be omitted if cost is an important factor.

In wiring the parts, complete the actual transmitter circuit first and then assemble the power supply, which can be mounted on a small subchassis fitted into the bottom of the cabinet. As indicated in the parts list, the power supply is built around a midget, receiving-type, power transformer rated at between 300 and 500 volts.

The key terminals and the meter should be wired into the *negative* side of the power supply. This is important since it protects the operator from any possibility of an accidental shock should he touch the transmitter cabinet or ground while keying.

Two plug-in coils are all that are needed to cover the twenty, forty, eighty, and 160-meter

This rear view of the cabinet shows the power supply and small parts



TRANSMITTER

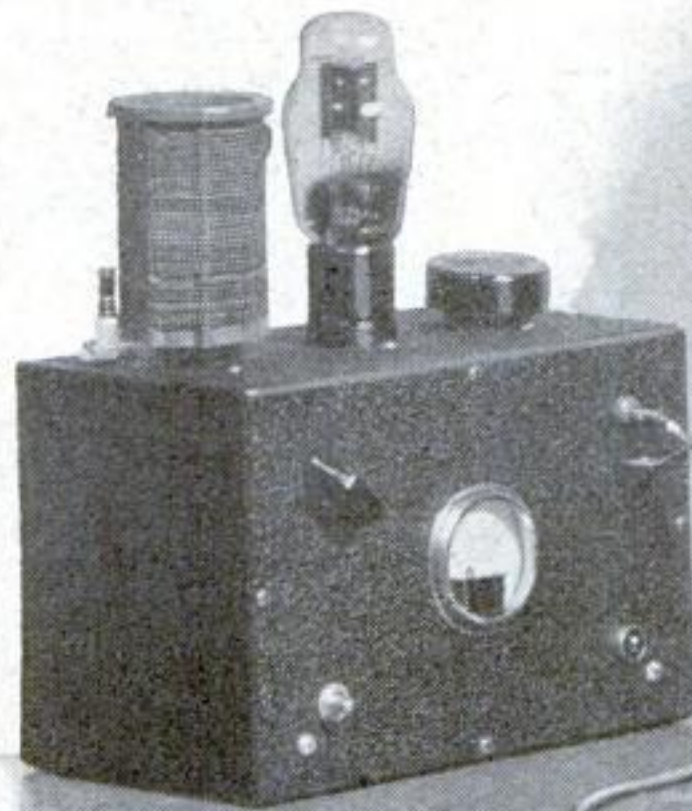
bands. For eighty and 160-meter operation, the coil consists of thirty-five turns of No. 18 wire wound on a two and a half-inch form. The twenty and forty-meter coil consists of ten turns of No. 14 wire on a one and one half-inch form. The antenna-coupling lead, brought up through one of the prongs, should be tapped into the first turn of the winding as shown in the diagram. The exact location for this tap is best found by trial and error, since much will depend on existing conditions.

Although a regular receiving antenna can be used, best results will be obtained by using a single wire designed for the proper wave length. To calculate the proper antenna length in feet, simply multiply the wave length to be covered (in meters) by 1.56.

On transmitting antennas, adequate insulation is an important consideration—far more so than in the case of any receiving antenna. Don't use cheap molded insulators; remember, one poor insulator may completely spoil your chances of getting maximum distance. A good grounding switch also is an important part of your antenna system. Suitable double-pole, single-throw units for this purpose can be obtained from any large dealer in radio parts. In wiring the switch, connect the center arm to the antenna lead-in, one jaw to the antenna lead to the transmitter, and the other jaw to a good outside ground.

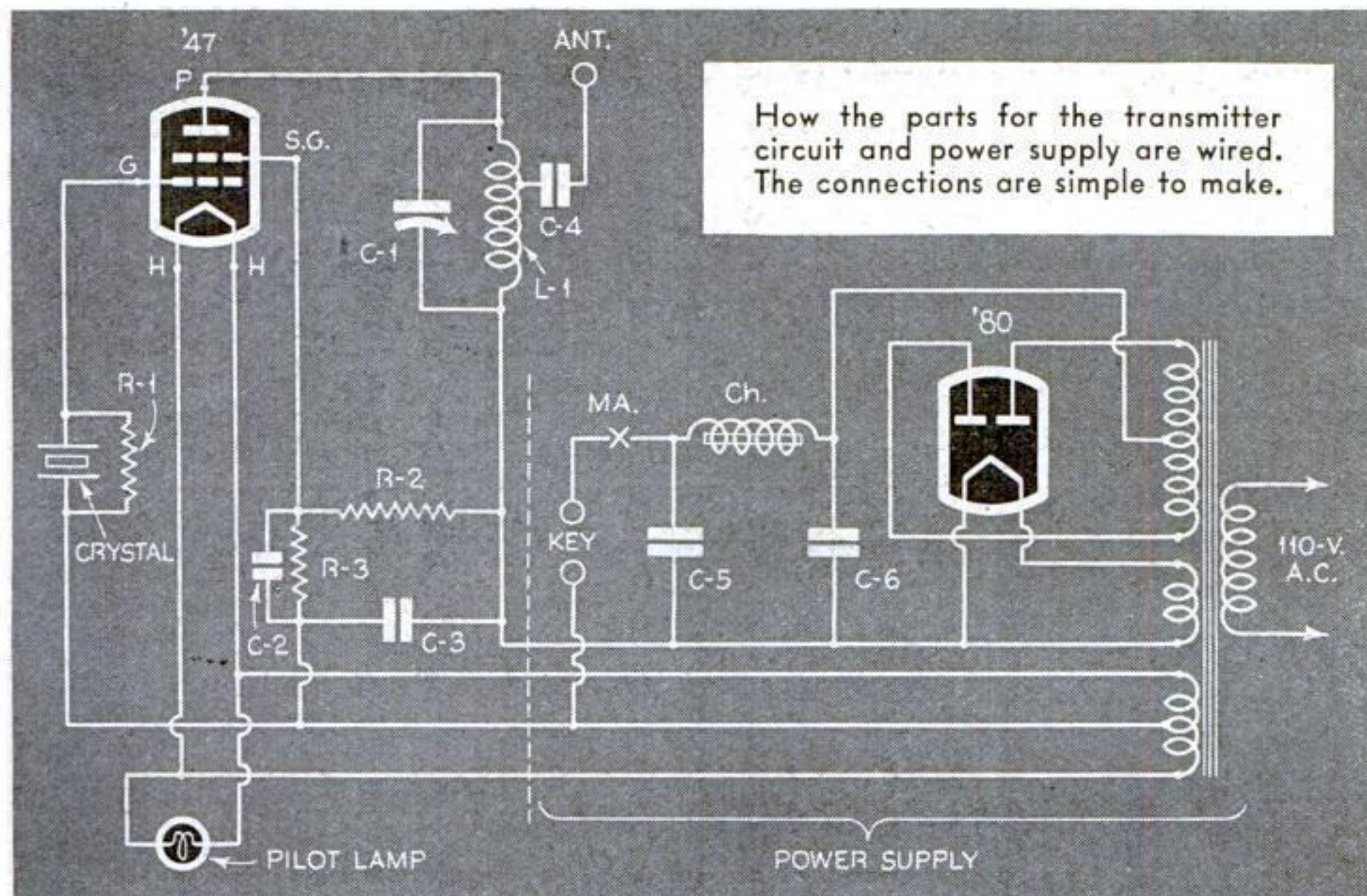
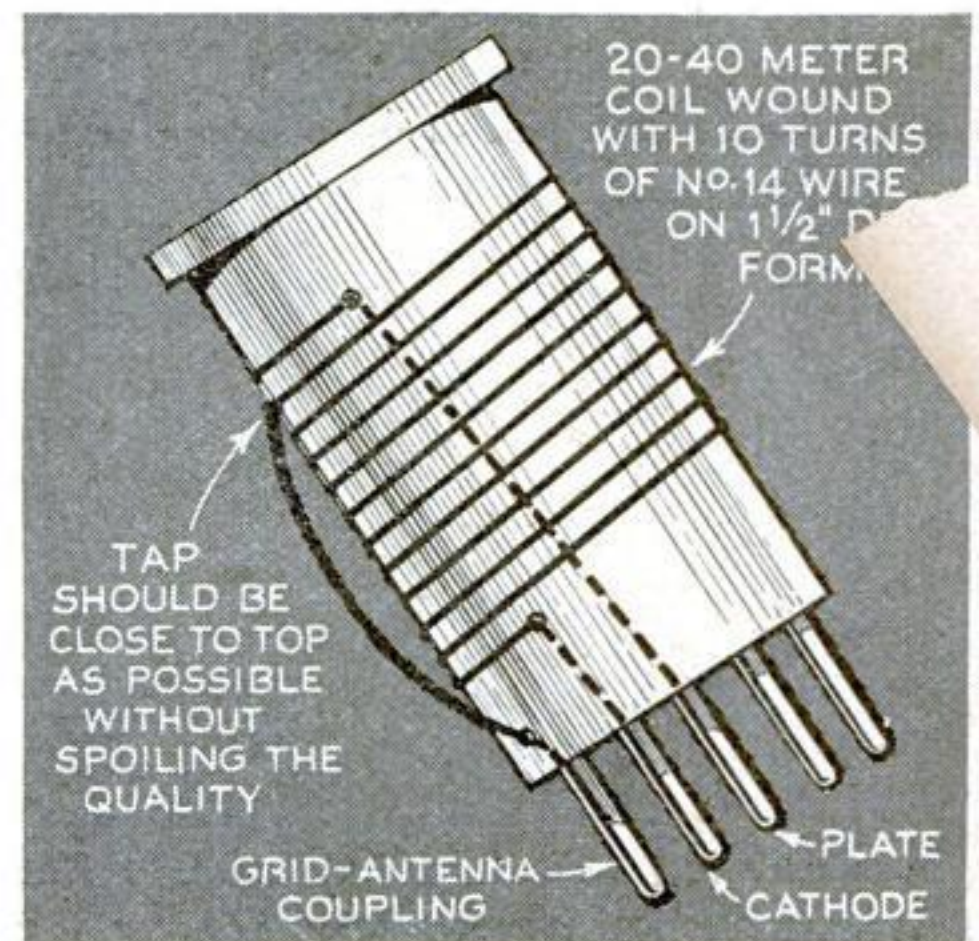
When adjusting the transmitter, the plate current, as indicated by the milli-

Only two coils, wound as indicated below, are needed to operate the outfit



ammeter, should drop when the variable condenser is turned through the point of resonance. For best results, the circuit should be tuned by holding a small pilot-type neon bulb close to the antenna lead and adjusting the condenser to the point where the bulb glows at its brightest.

As with all transmitters, this circuit must not be put on the air unless you are the holder of an amateur license. However, the lack of a Federal certificate need not prevent you from constructing the outfit. In building it, you will learn a great deal that will assist you in passing your license examination.



How the parts for the transmitter circuit and power supply are wired. The connections are simple to make.

PARTS YOU WILL NEED

- C₁.—Tuning condenser, .0001 mfd.
- C₂ and C₃.—Fixed condensers, .01 mfd.
- C₄.—Fixed condenser, .00025 mfd.
- C₅ and C₆.—Dual electrolytic condensers, 8 mfd.
- R₁.—Fixed resistor, 50,000 ohms.
- R₂.—Fixed resistor, 50,000 ohms.
- R₃.—Fixed resistor, 50,000 ohms.
- L₁.—Plug-in coil, see text.
- XTAL.—Control crystal (wave length desired).
- MA.—Milliammeter, 0 to 100.
- CH.—Filter choke, midget.
- Miscellaneous.—Cabinet, sockets, tubes, insulators, coil forms, wire, toggle switch, neon bulb, pilot light and jewel, knobs, pin-tip terminals, key, power transformer (350-350 volts, 5 volts, 2.5 volts), etc.

GUS says...

Quit Stalling!

The Veteran Mechanic
Tells What To Do When
Your Motor Goes Dead

"MIGHT as well be trying to drive a submarine!" Jim Devon growled disgustedly, as he leaned forward in an attempt to see more clearly through the sheets of water streaming down his windshield. "Just our luck to run into a storm like this!"

"You're pretty hard to please, Jim," his wife observed. "After all the fine weather we've had on this trip, you growl because we happen to run into a little rain in the last few miles! I'd say we've had extra-good luck with the weather."

"Sure we have, dear," Jim smiled. "Don't mind me. You know I always did hate driving in the—what the dickens has happened now?"

They had stopped for a traffic light and, as Devon was talking, the motor suddenly stalled. He stepped on the starter again and again, but the motor refused to start.

"That's funny," Devon muttered, "never did that before. I guess one of the spark plugs has gotten a soaking. Gimme the umbrella while I wipe them off."

Holding the umbrella so that it protected the motor as well as himself, Devon carefully wiped the insulator of each spark plug and the surface of the cable leading to it. When he climbed back into the car and stepped on the starter pedal again, the motor started at once.

"Guess I know my onions!" he bragged, as they started down the road. "Now, as I was saying—" He did not finish the remark, for the motor interrupted it by going dead again.

"Now what in thunder is the matter?" Devon exclaimed. "Can't be the spark plugs this time, because it's almost stopped raining. Maybe there's a loose wire somewhere."

He got out a screw driver and pliers and tested all the wire connections he could get at conveniently, but found nothing loose.

"Humph!" he grunted. "Must be a burned-out coil or something. Well, guess I'd better phone the Model Garage and have Gus tow us the rest of the way home—it's only three miles or so."

"First try it again. Maybe it'll work now," his wife suggested.

Devon followed her advice, and the motor started at once. However, it skipped explosions and showed signs of stalling again at slow speed, so that



Holding the umbrella so that it protected the motor as well as himself, Devon carefully wiped off the insulator of each spark plug and then the surface of the electric cable leading to it

he had to keep his foot on the throttle all the time in traffic.

"Take me home first, so I can get dinner started," his wife suggested, as they came in sight of the Model Garage, "and then you can run back and have it fixed while the meat is cooking."

"O.K. by me, if it'll run that far," Devon growled.

Ten minutes later, he pulled up in front of the Model Garage with the motor racing. As Gus Wilson, mechanic and half owner of the establishment, came over to him, he took his foot off the throttle pedal and the motor stalled almost at once.

"That makes the third time it's gone to sleep like that in the last half hour, Gus. See if you can find what's the matter."

As Gus lifted the hood, the odor of raw gasoline filled the air. The outside of the carburetor was dripping with the fluid.

"Shouldn't be hard to find that trouble," Gus muttered. "The motor is being drowned in gasoline. Either the

carburetor float has sprung a leak, there's dirt under the float needle valve, or it's a combination of a tiny bit of dirt under the float needle plus too high fuel-pump pressure."

"And I thought it was rain on the spark plugs!" Devon growled, crest-fallen.

"No ordinary rain ever stopped a motor once it was warmed up well," Gus maintained, "unless the distributor cap leaked water or was cracked, or something like that. Of course, in the kind of a rainstorm we've just had, enough water may be blown through the radiator or sideways through the hood louvers to make one or two of the spark plugs skip a few explosions, but the heat of the engine at normal running temperature will evaporate any water that hits them in no time at all."

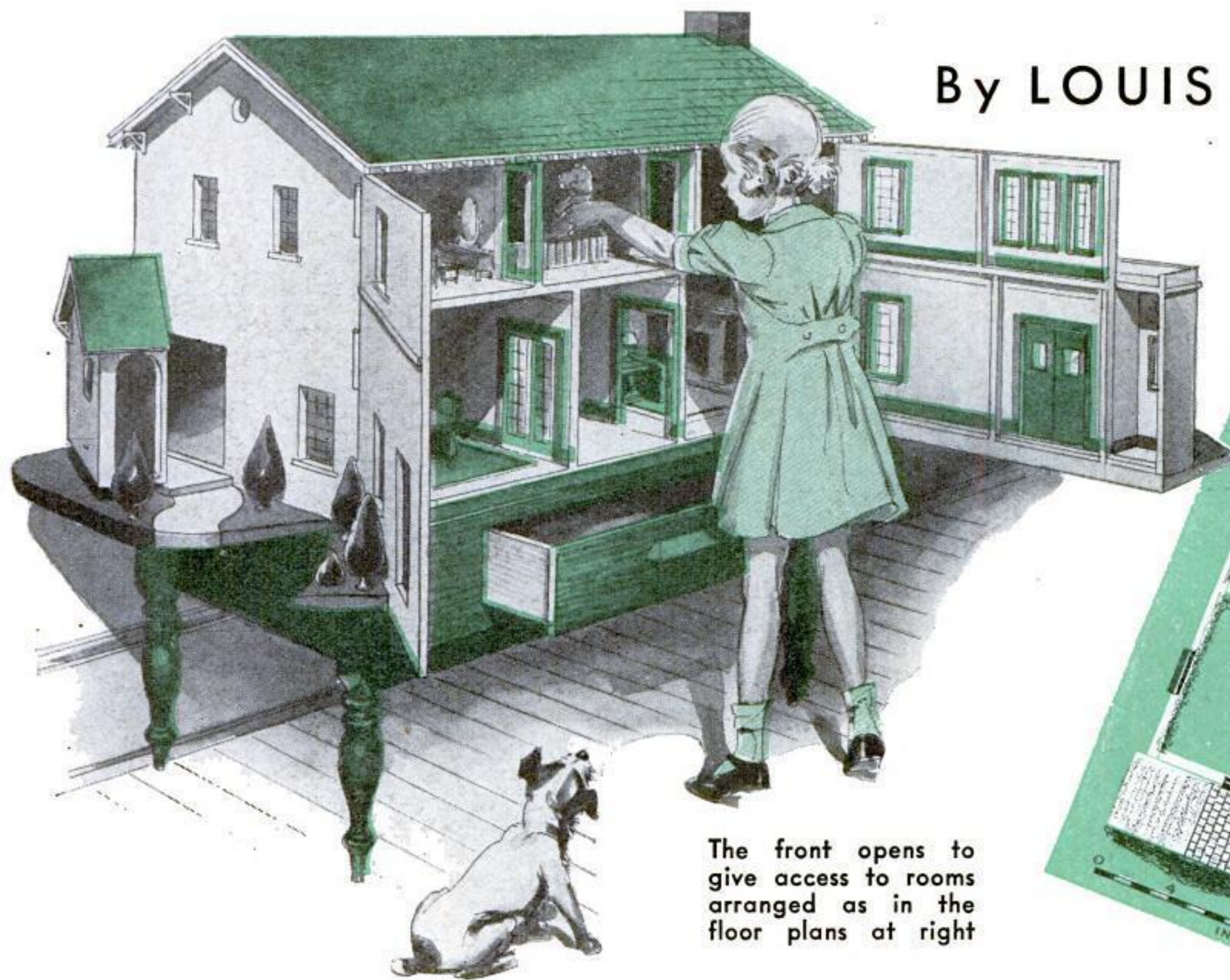
"No," continued Gus, as he got out his tool kit and started to remove the carburetor, "about the only time rain puts the ignition out of kilter is when you leave the car in the rain for hours till it is stone-cold and a film of moisture settles all over the plug insulators and the high-tension wiring as well. Sometimes a (Continued on page 147)

By MARTIN BUNN

THE HOME WORKSHOP

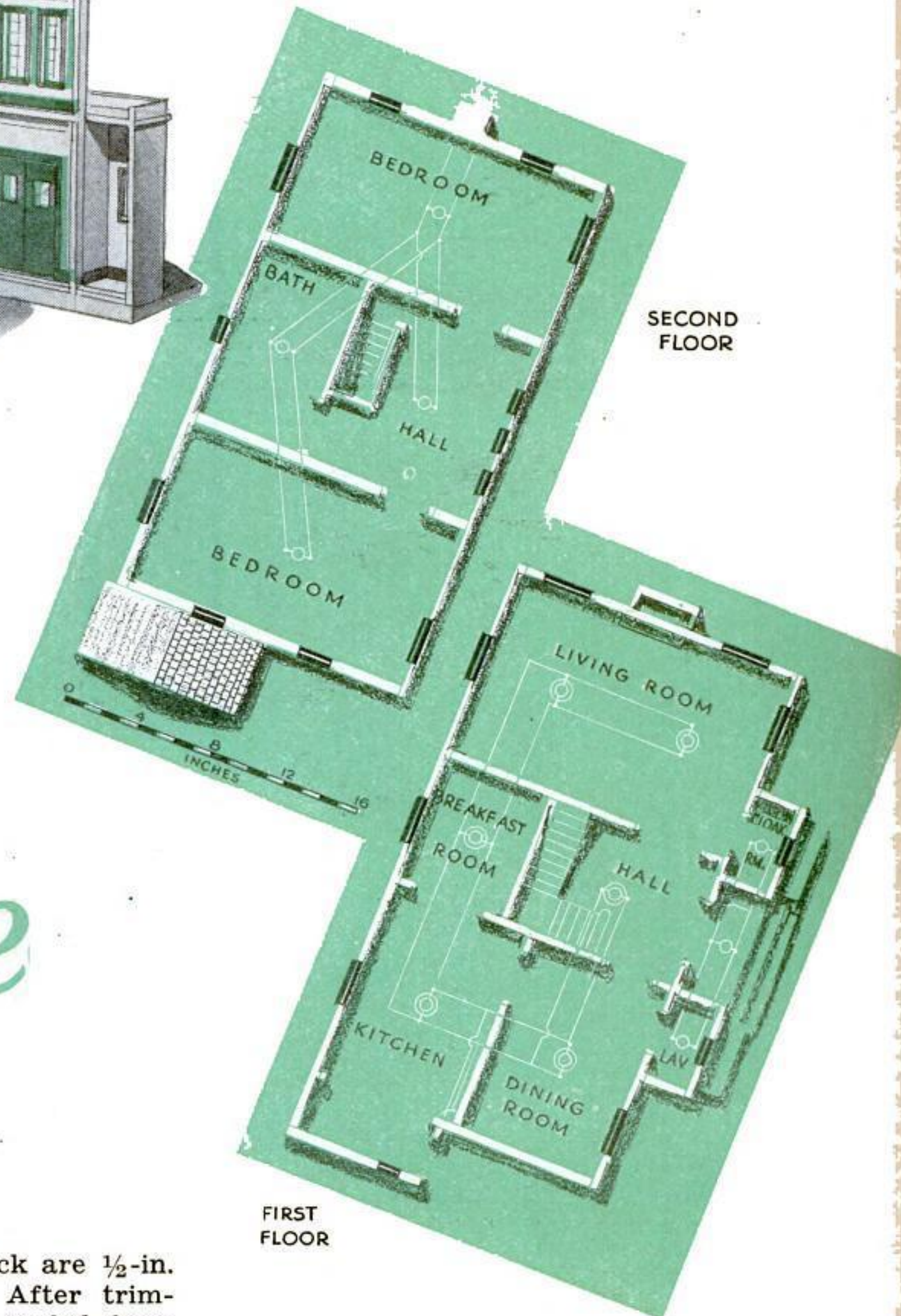


By LOUIS A. LEMBACH



The front opens to give access to rooms arranged as in the floor plans at right

Quali tre doll ho



DESIGNED to be an attractive piece of furniture as well as a toy, this doll house is a source of endless pleasure to its little owner. The front swings on hinges so that it can easily be opened and closed even by a very small child. The side entrance gives access to kitchen and breakfast room.

The house proper, without the overhang and projecting porches, is 29 in. long, 16 in. wide, and 20 1/4 in. high. The overall size, including the table, is 43 in. long, 24 in. wide, and 36 in. high.

It happens that this house is a scale model of an actual residence, but those who wish to build a similar toy need not, of course, copy it exactly in either design or dimensions.

Table. The house rests on a substantial table built of walnut as shown on a following page. This keeps it off the floor, where it might be damaged, and enables the small housekeeper to play comfortably with it without sitting on the drafty floor. There is a large drawer in front. The joints may be either mortised or doweled, as preferred.

Sides. These and the back are 1/2-in. pine (or 1/2-in. veneer). After trimming them to dimensions scaled from the plans on the following pages, cut in all the openings. The strips of 1/8-in. walnut that represent the casement windows are half-lapped where they cross, and are mortised into the side walls flush with the inside. Celluloid serves for glass. The fireplace also should be built at this time. The one pictured was made of a modern plastic material 1/8 in. thick—a yellow piece nailed to the wall, and a polished black piece cemented on top. Extend the sides of the plastic below the floor line as they will be covered up later. Glue and screw the three sides together and onto the table with cleats placed along the edge so as to form a support for the floor.

First floor. Gum veneer 1/4 in. thick with lines scored parallel to the grain 1/4 in. apart, stained walnut, shellacked

and waxed. Floors and partitions come within 1/2 in. of the front; each one is to be completed on the front wall later.

Stairway. Each step is a separate block of wood. The tread can easily be cut on the circular saw by running it through a second time. Nail from the bottom. When each straight section is completed, cut a rabbet along the front lower edge to receive the paneling. Build firm supports before it is paneled. The banister is wood except for the stiff wire posts.

First-floor partitions. The exact height of the stairs will dictate the height of the partitions. A strip of walnut on the front of each wall will prevent it from warping.

Size all surfaces and apply wall pa-

BUILT LIKE A FINE PIECE OF FURNITURE, THIS TOY IS A COMPLETELY EQUIPPED MINIATURE HOME

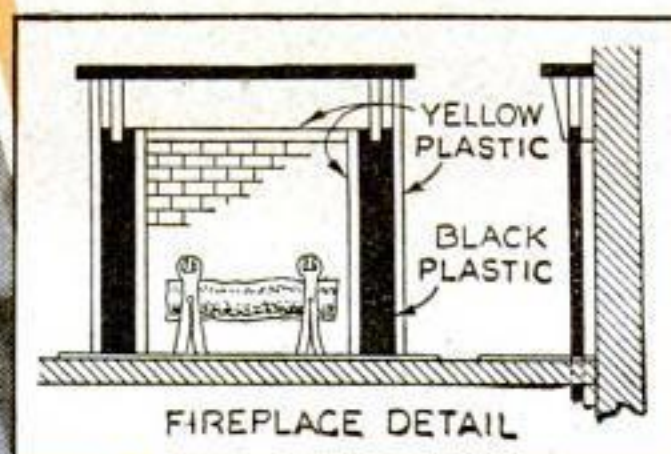
per, preferably of a sunproof, washable type. A large sample is sufficient to paper a room. Paper over door and window openings, then cut to size. The border, a strip cut from a large one, is left until the house is completed.

Woodwork. An assortment of $\frac{1}{8}$ -, $\frac{1}{4}$ -, $\frac{3}{8}$ -, and $\frac{1}{2}$ -in. walnut will be found handy for all the finishing. The door frames are cut in one piece and run through a second time to make the molding. The mop boards are $\frac{1}{8}$ by $\frac{1}{4}$ in., one edge rounded. The French door is made by cutting two pieces of $\frac{1}{8}$ -in. walnut to shape and cementing them to a sheet of celluloid. Each door is hung on pins, top and bottom. The lower pin goes into the tread, which is nailed on last. All other doors are solid. Hang the first-floor windows at this time, using celluloid for glass. The windows are more easily fitted if made before the sides are nailed together, then laid aside.

Ceiling. Score the top for flooring as on



The house closed. There are twenty-three outside windows with celluloid for the glass



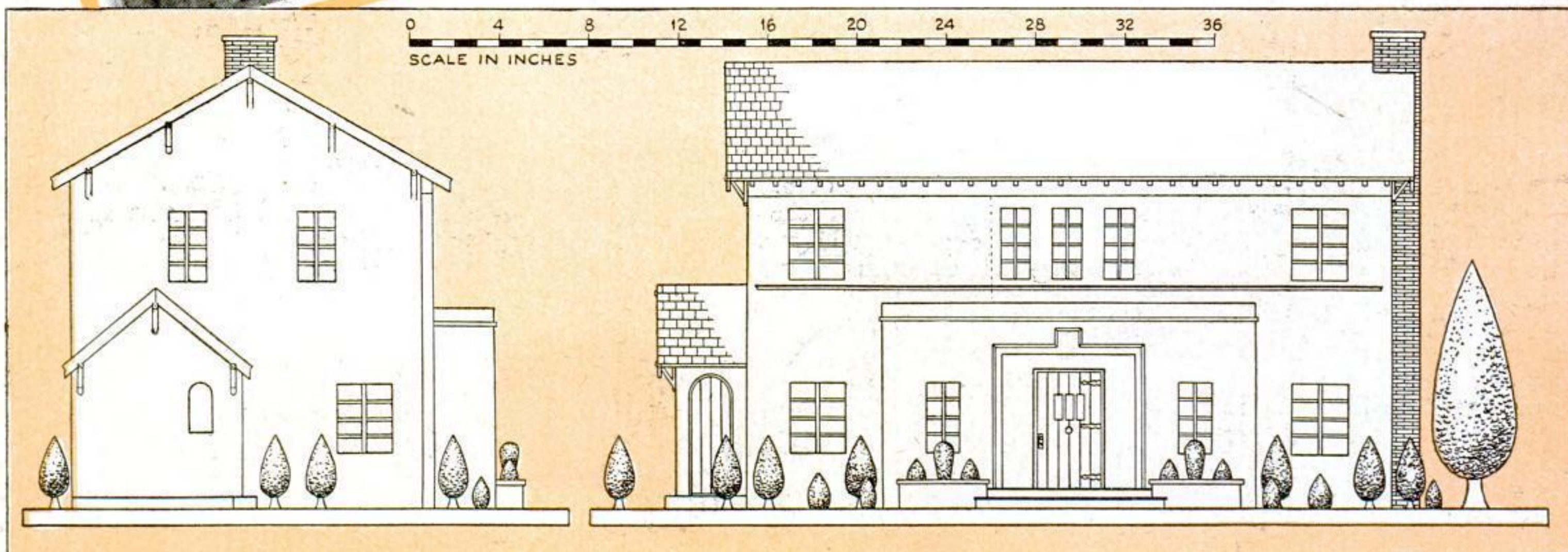
Dining and living rooms, and fireplace drawing. The lamps are flash-light bulbs lighted by a six-volt transformer

the first floor. Since the first floor ceiling carries all the wiring for six lights, run grooves with the circular saw just deep enough to bury the wire. The light fixtures are small Christmas-tree lighting strings. Cut these apart, and using the same cord, wire in parallel. Insulate well where the wires cross, and bury them in plastic composition wood. This wire carries only six volts as supplied to flash-light bulbs by a toy transformer fastened inside table. Size and paper the ceiling before the light fixtures are nailed down.

Second floor partitions. Make these, then paper and install the woodwork.

Second-floor ceiling. Since the entire front of the house is open and the sides

WORKING DRAWINGS FOR



LIST OF MATERIALS

- 3 pc. soft white pine $\frac{1}{2}$ by 8 in. by 6 ft. for sides, back, chimney, and partitions (or use plywood).
- 1 pc. common lumber 1 by 6 in. by 9 ft. for yard and back of table.
- 1 pc. $\frac{1}{4}$ -in. fir veneer 3 by 8 ft. for front, ceiling, roof, and drawer.
- 1 pc. $\frac{1}{4}$ -in. gum veneer 3 by 3 ft. for floors.
- 2 pc. walnut 2 by 2 by 30 in. for table legs.
- 1 pc. walnut 1 by 6 in. by $4\frac{1}{2}$ ft. for table.
- Assorted $\frac{1}{8}$ -, $\frac{1}{4}$ -, $\frac{3}{8}$ -, and $\frac{1}{2}$ -in. walnut for finishing woodwork and stairs.
- Light fixtures and 13 flash-light bulbs, 6.2 volt.
- Celluloid for windows.
- Paint, glue, nails, screws, etc.

Note: The cost will vary according to quality of materials, locality, and other factors. In the writer's case, it was \$9.85.

support the front wall and porch, the second floor ceiling will have to be heavily braced, from each corner to the diagonally opposite corner, with one by two's to prevent the house from warping. Wire the light fixtures through the attic and run the lead down the fireplace chimney to the transformer.

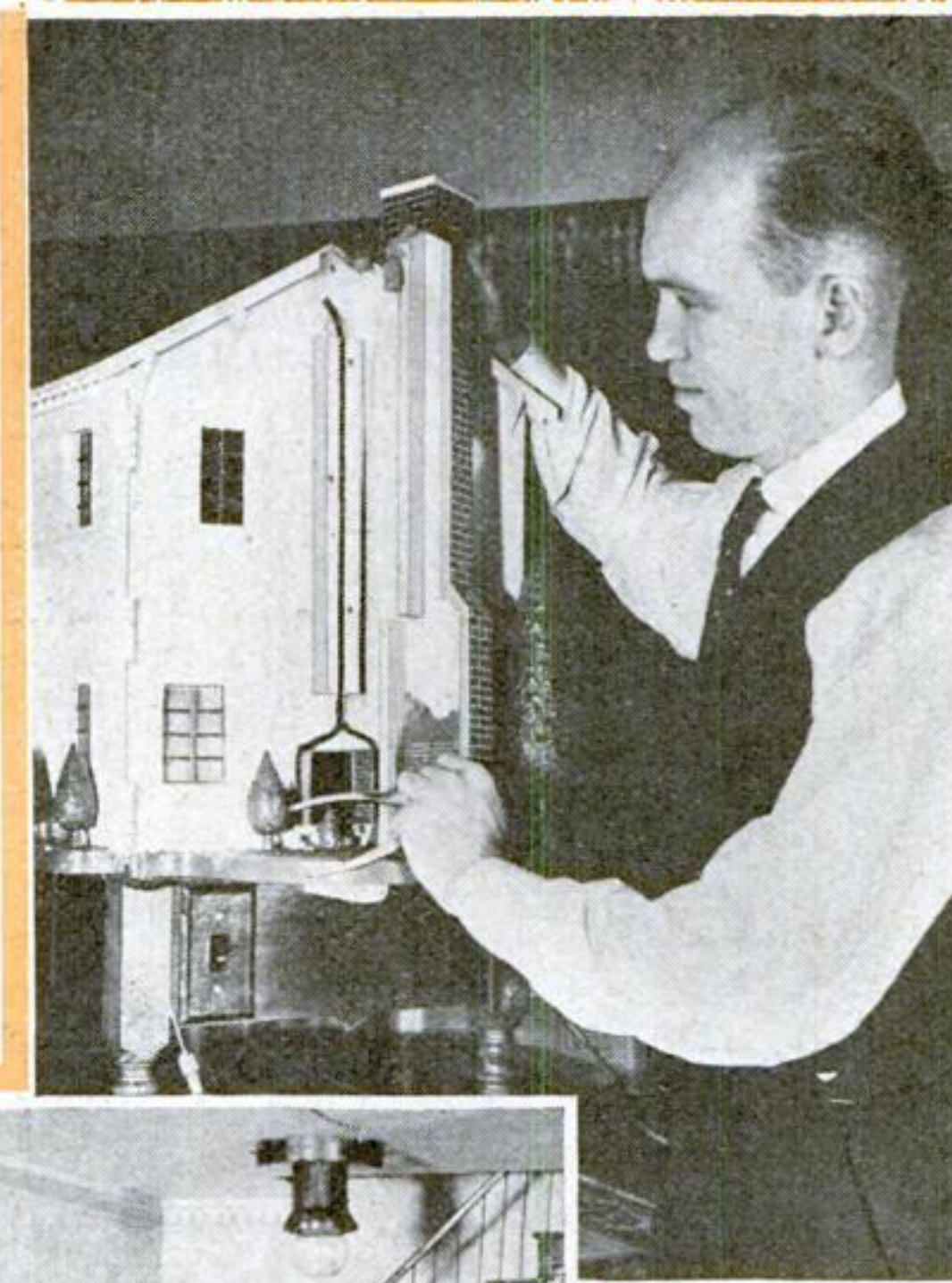
Roof. Quarter-inch veneer is used. It is painted green, ruled to represent shingles, and varnished. Real shingles are an improvement, but only if they can be made to scale.

Front. To prevent warping, this is best made of two sheets of $\frac{1}{4}$ -in. plywood, glued together and dried under pressure. After cutting openings and trimming panels to size, build on pieces for ground and porch. Before fastening permanently, wire the two rooms at each side of entrance and the entrance for lights, paper them, and install woodwork. If long piano hinges are not available, mortise in three strong butt hinges on each side. Use long screws into the side walls, and rivet those into the front.

Chimney. Build up of wood with lines scored in to represent bricks. Cover with wax paper for protection and attach to house temporarily.

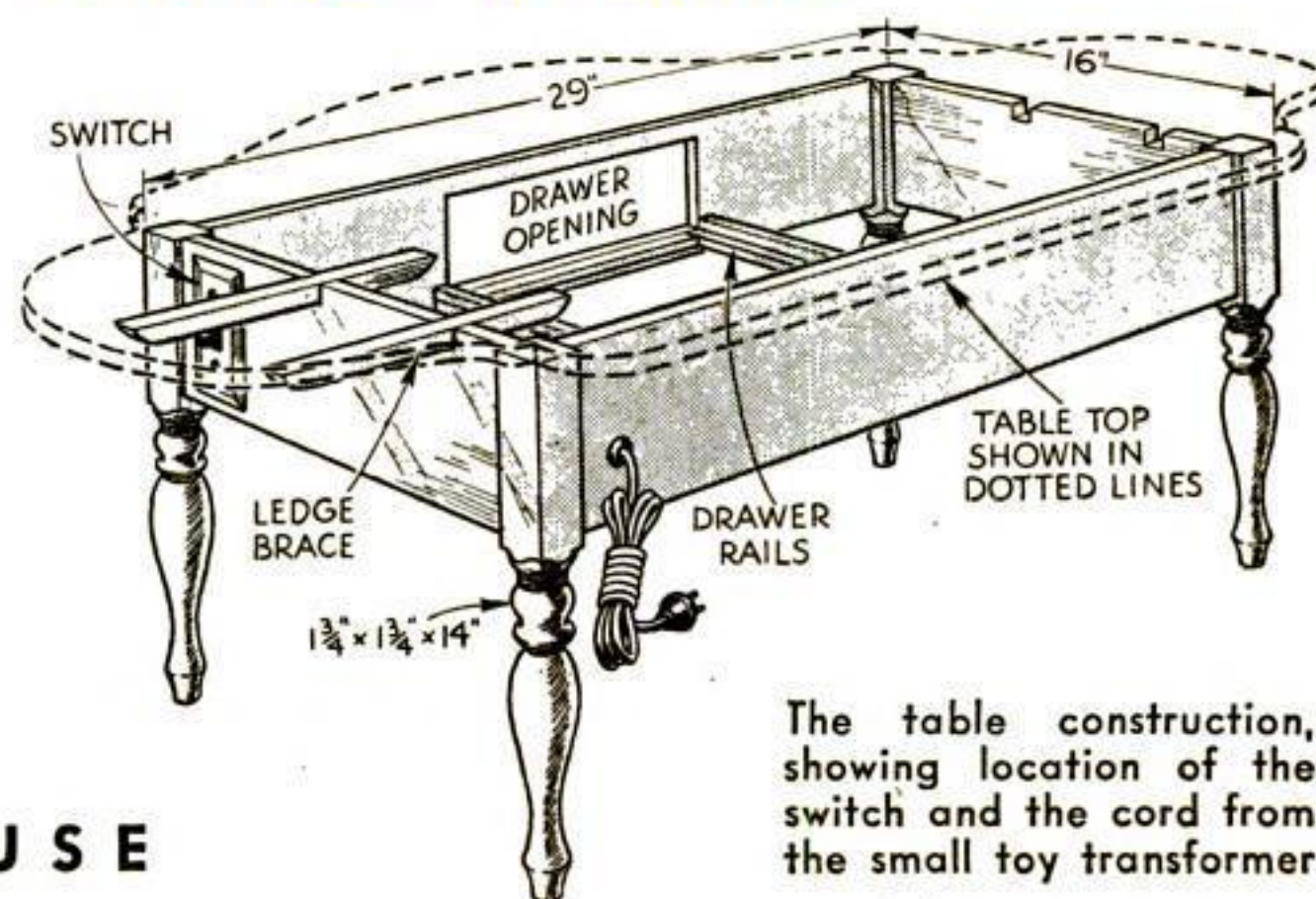
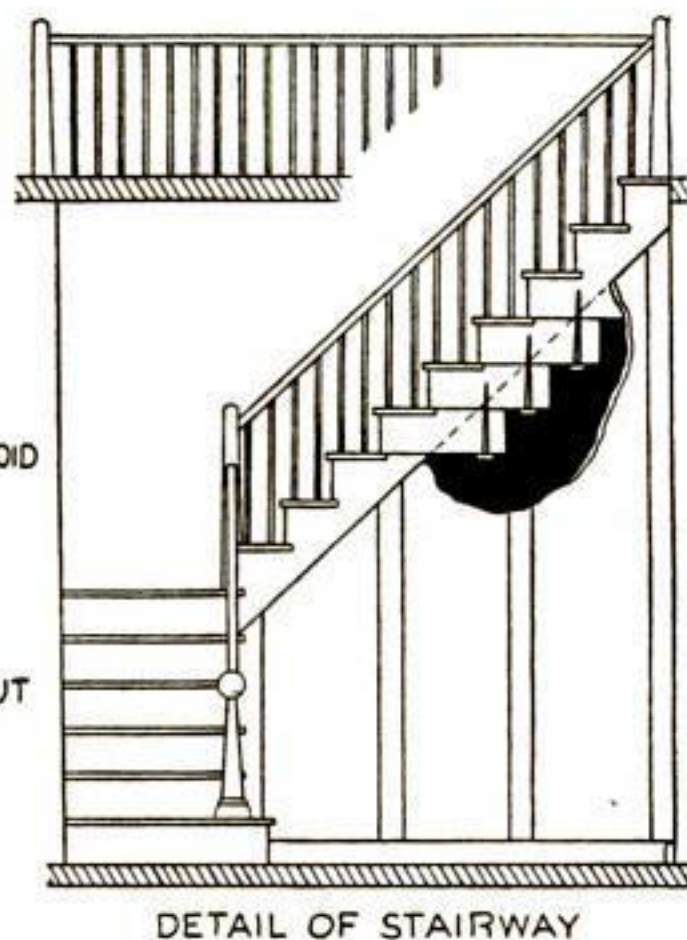
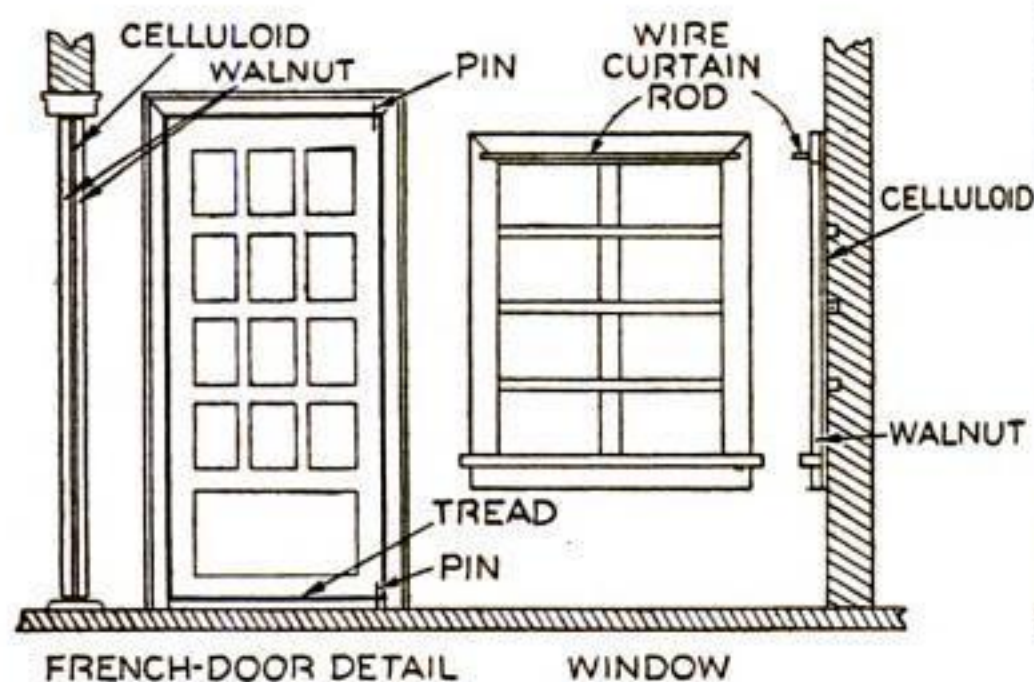
Exterior finish. Two coats of paint are applied for a foundation, and a heavy coating of plastic paint to give the effect of stucco. Then daub with the end of a $\frac{1}{2}$ -in. brush. Apply white enamel when thoroughly dry to protect the finish.

Landscaping. Turn trees and shrubs from wood. Paint them and the lawn green. Sidewalks are given a coat of light gray enamel.



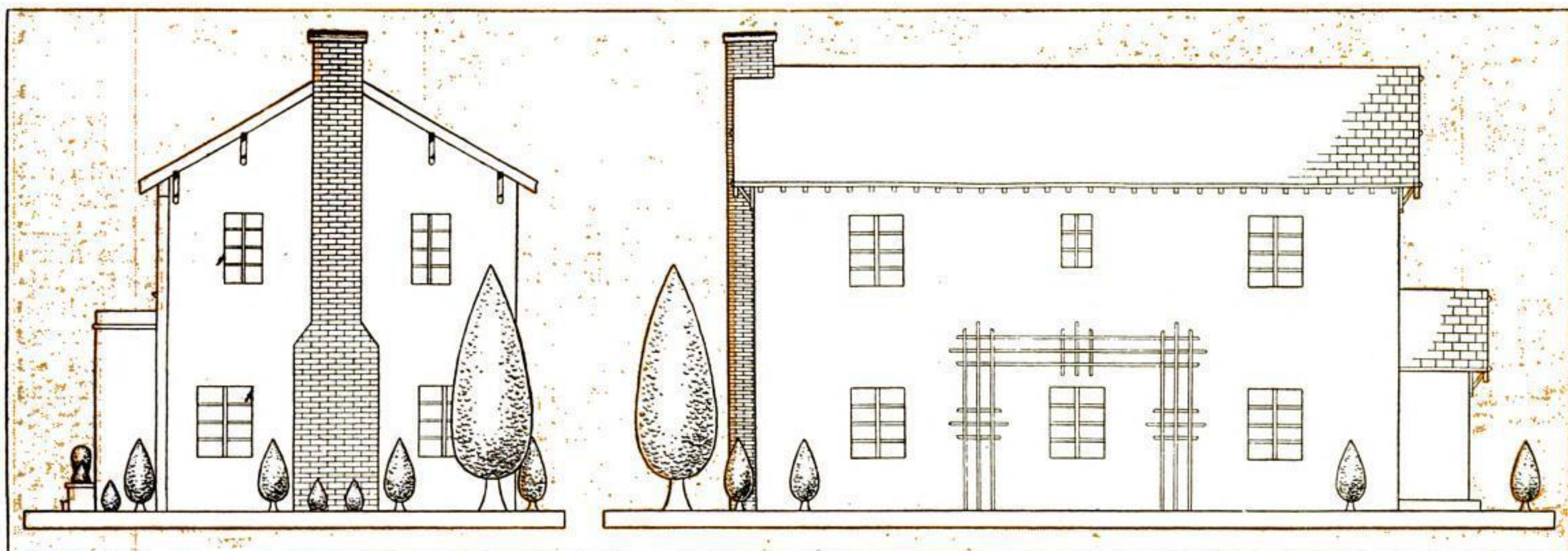
How the light wires are carried up the house where they will be concealed by the chimney, which is a unit by itself with brick lines scratched in. Left, the stairway and French door

Details of the French door, windows, and stairway. The French door is the dining-room entrance; all other doors are solid. Pins serve as the hinges



The table construction, showing location of the switch and the cord from the small toy transformer

THE QUALITY-STREET DOLL HOUSE



A squeegee is used to smooth the paper

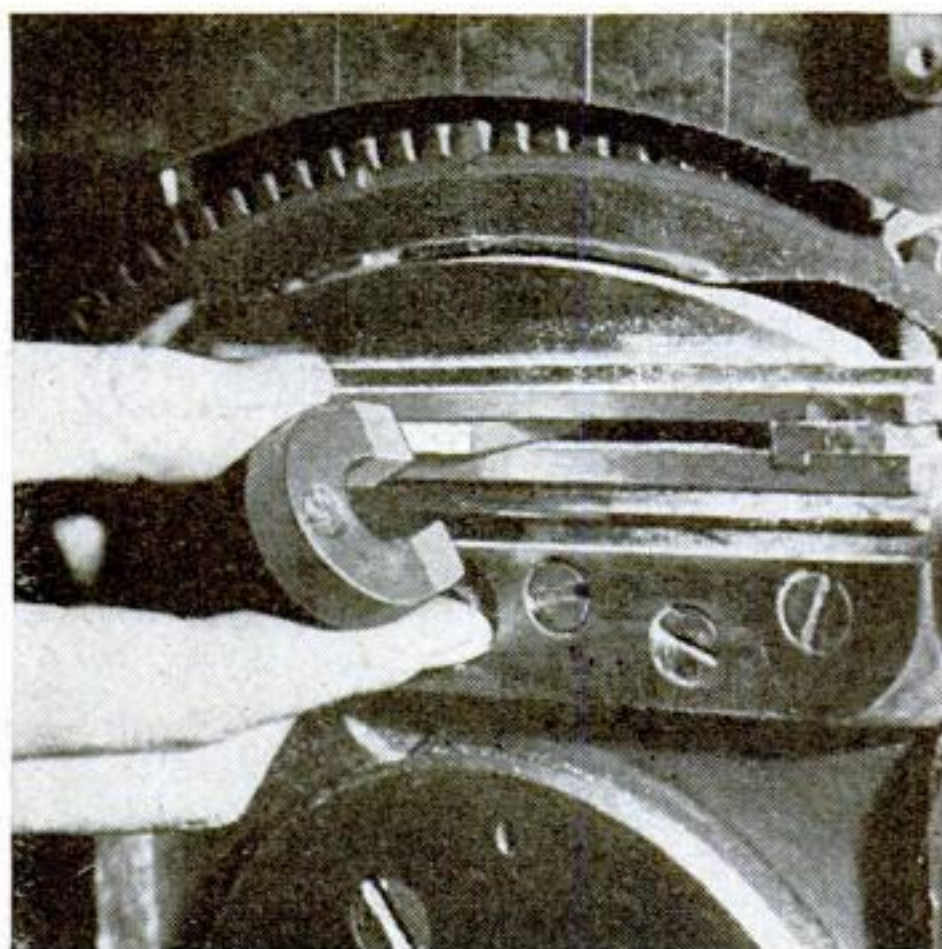


Wall Paper Hung with Aid of Ordinary Squeegee

THE amateur paper hanger who does not wish to invest in an expensive smoothing brush for a small job of wall papering will find that a window squeegee serves the purpose satisfactorily. The long rubber edge will smooth the paper onto the wall without damage to the pattern, and will also tuck it sharply into corners.

Magnet Removes Liners from Linotype Molds

MANY times a day the linotype operator who runs a so-called "ad machine" has to change the hot liners in the molds. The danger of burning his fingers can be avoided by using a small magnet, which will remove the liners quickly after the mold cap screws have been loosened. The magnet is also useful for retrieving screws that fall into the lead shavings—JACK HONRINE.



No burned fingers when a magnet is used

Tray Catches Articles Dropped from Bench

RELATIVELY few amateur craftsmen and model makers have ever seen the inside of a shop where jewelry is actually made, otherwise they would have long since adopted the convenience illustrated—a "tray," as it's called in the trade. It is nothing more than a shallow drawer arranged to pull out at a point just above the worker's knees.

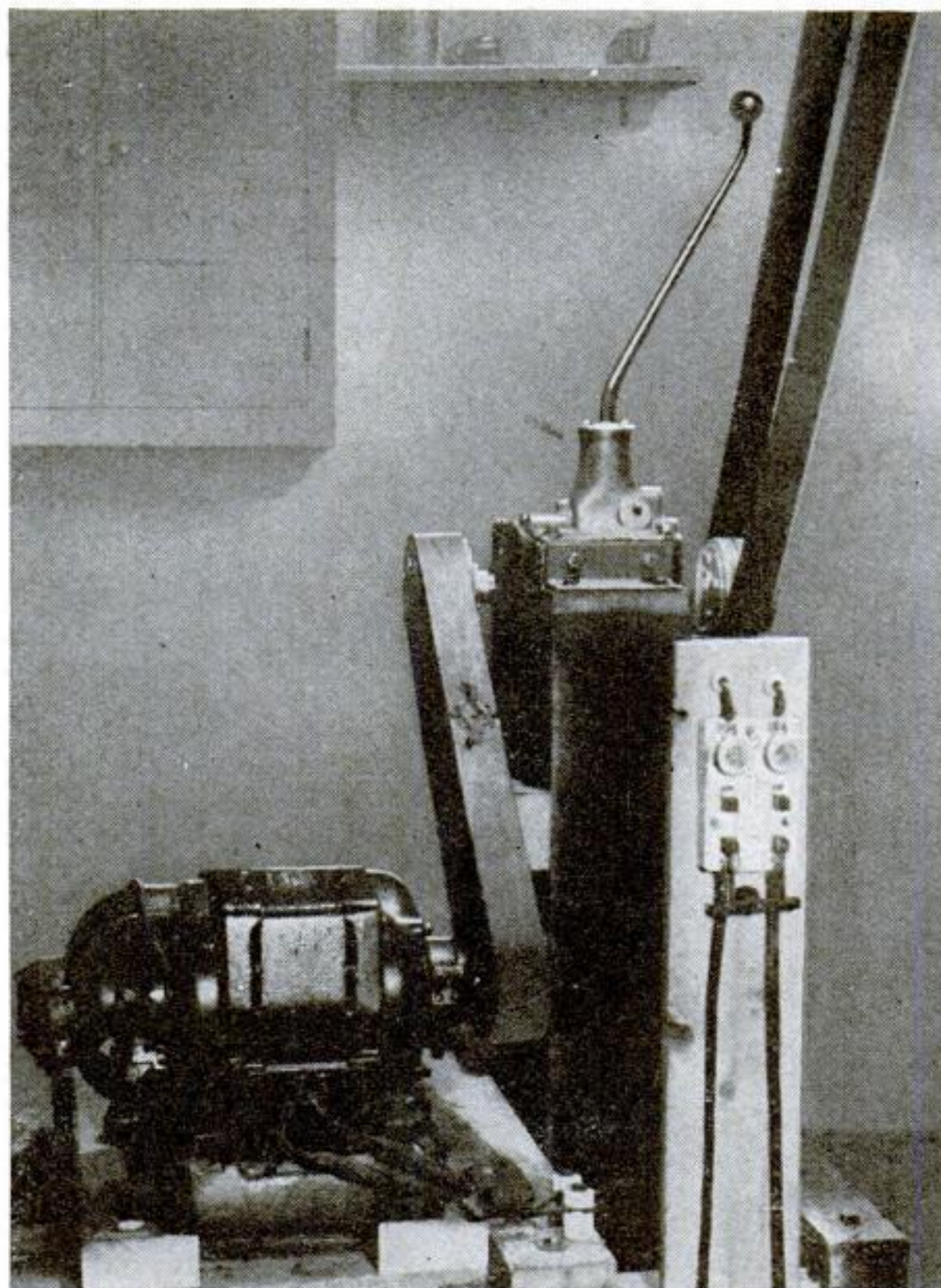
A piece of paper is laid in the bottom when necessary to catch filings, dust, and scraps of any precious metals being worked, and the tray also holds small tools in use. If it served no other purpose, it would be invaluable for catching things that are accidentally dropped and often get lost or damaged on the floor.

Another great aid is the bench pin or filing block, shown projecting from the



The shallow drawer pulls out at a point just above the knees

edge of the bench. It can be made from maple or similar hardwood, or bought for a few cents. The top of the wedge-shaped end comes flush with the top of the bench, and either side may be used up. The other end of the bench pin is in the form of a tenon that fits tightly into a mortise cut into the edge of the bench.—JOSEPH HAGANS.



How the transmission is set up alongside the shop motor

WHEN the small engine lathe is the only lathe in the shop, it is usually employed to turn wood as well as metal. If, however, the lathe is driven fast enough for good wood turning, it will be too fast for metal, even with the back gears engaged.

By using an old auto transmission as shown, the lathe can be driven at almost any desired speed simply by shifting the gears of the transmission and changing the belt and gears of the lathe. The transmission should be belted so that in high or direct drive the

Auto Transmission Gives Variable Speeds in the Shop

lathe will be driven fast enough for wood turning.

Clean the transmission thoroughly. The bell part of the casting that goes up to the flywheel housing should be broken away from the gear case by drilling small holes close together all the way around the bell part, close to the gear case. Tapered pins or cold chisels are driven into these holes to split the unwanted part away.

As the transmission I used had a shaft at each end that was not tapered, it was an easy matter to fit on a flange turned from a casting made from a simple pattern (or the flanges may be turned from solid stock).

Pulleys were turned from hardwood and bolted to each flange, which was then fastened to the shaft with set

screws. A hole was turned into one side of each of the pulleys the same diameter as the flange and the same depth as its thickness, to bring the pulley nearer the bearing. The pulleys used were made the same diameter as the pulley on the motor; this gives the same speed on the power take-off side of the gear case, when running in high, as that of the motor.

The gear case was mounted on supports by means of angle irons. The heavy oil used in the gear case should be thinned.—HARLAND S. MARDEN.

Novel Sundial

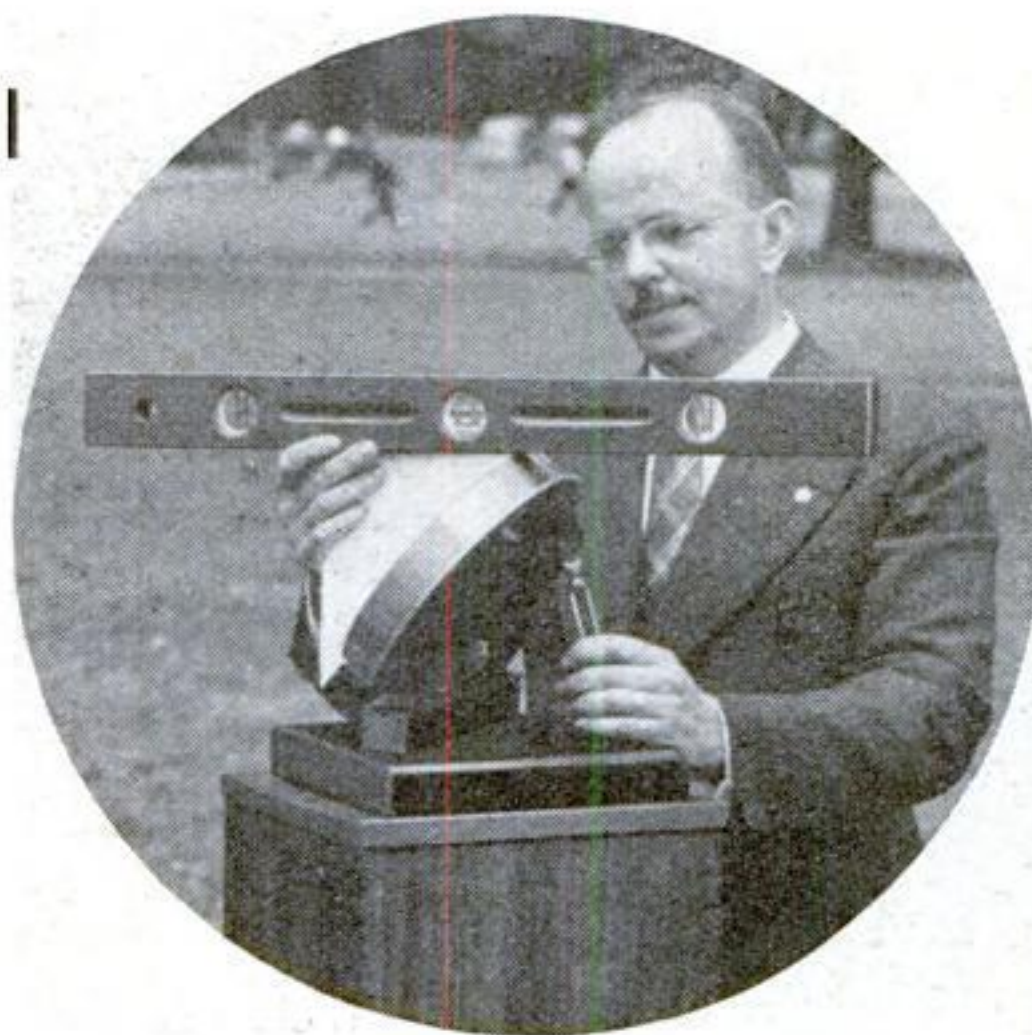
RIVALS CLOCK IN ACCURACY

By
Allen McManigal

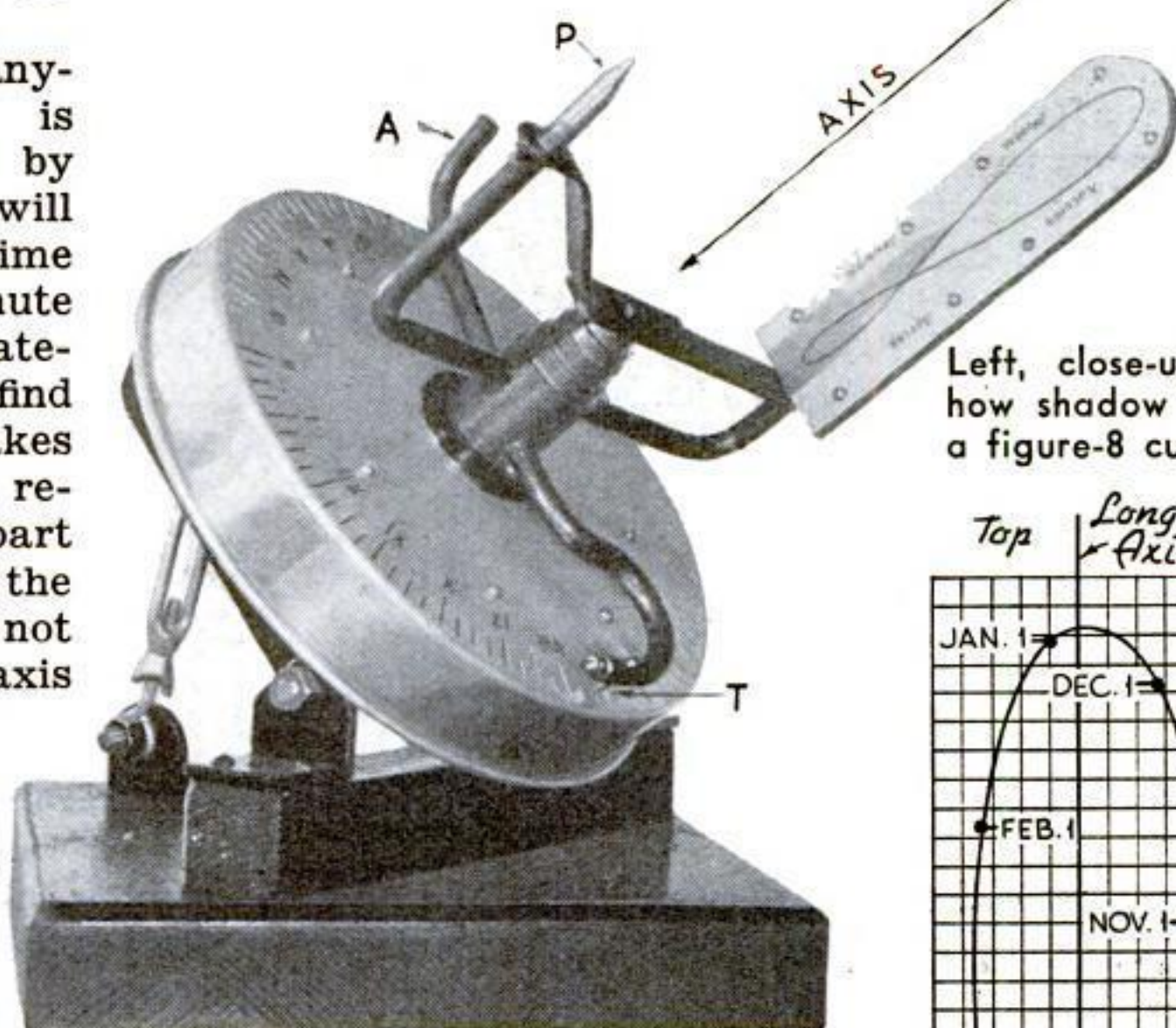
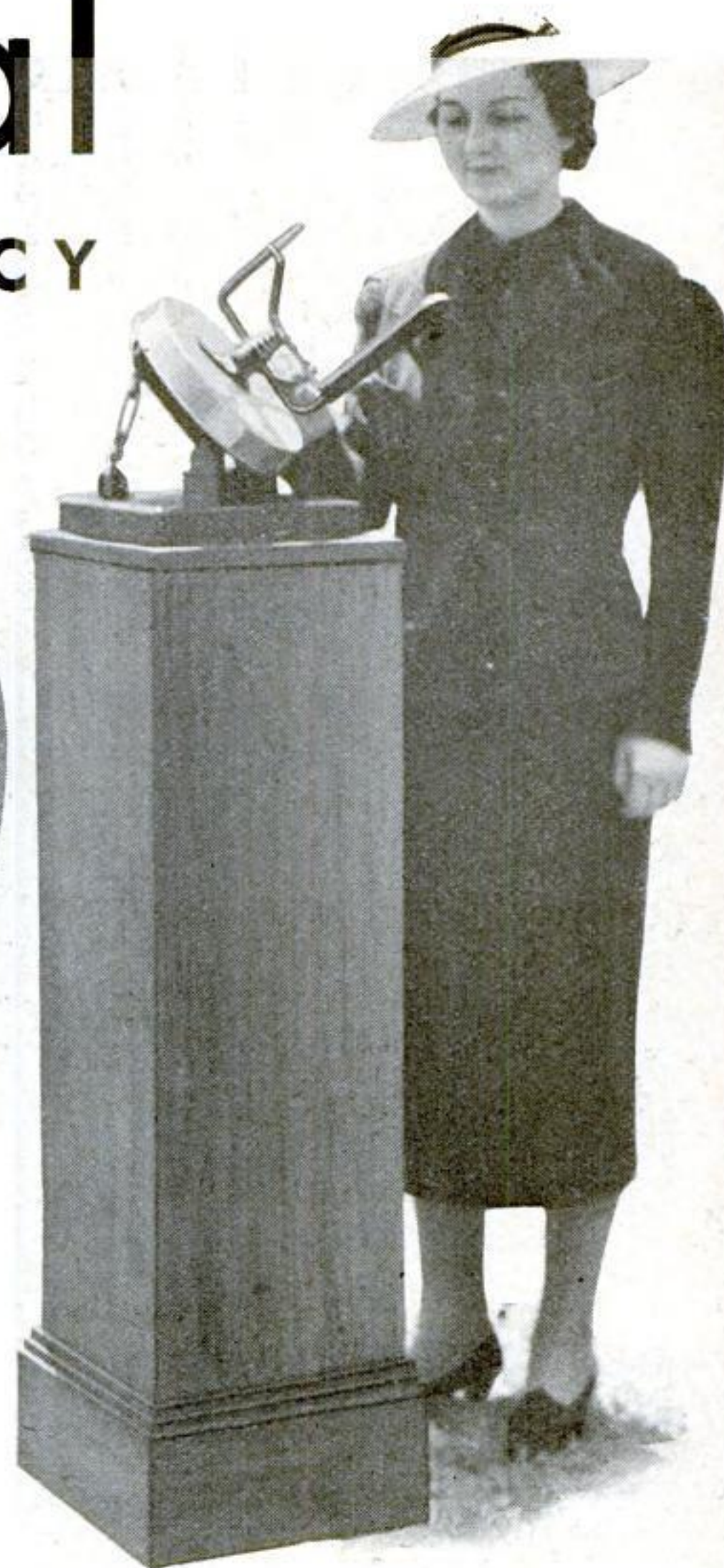
MOST sundials are more decorative than time-indicating. Devised centuries ago when a few minutes, more or less, made little difference, they have not experienced much change in their fundamentals.

The usual garden variety of sundial has the clock face in either a horizontal or a vertical position. These dials consider only one of the three apparent motions of the sun that affect a sundial. There are two objections to this, in the writer's opinion. First, the indicated time is not standard time because the dial varies more than thirty-two minutes throughout the year. Second, the graduations on the time-indicating scale, not being uniform, make it difficult to interpolate the indicated reading.

In the accompanying illustrations is a sundial made by the writer that will indicate standard time to the nearest minute and also approximately the date. To find the time, one takes hold of arm A and revolves the upper part of the sundial (the clock face does not move) about the axis



Using a cardboard template and carpenter's level to adjust the sundial by means of a turnbuckle. At right, the apparatus set up. It shows not only exact standard time, but the date as well. The cost is about \$1.50



Left, close-up of dial. Note how shadow of pointer traces a figure-8 curve, or analemma

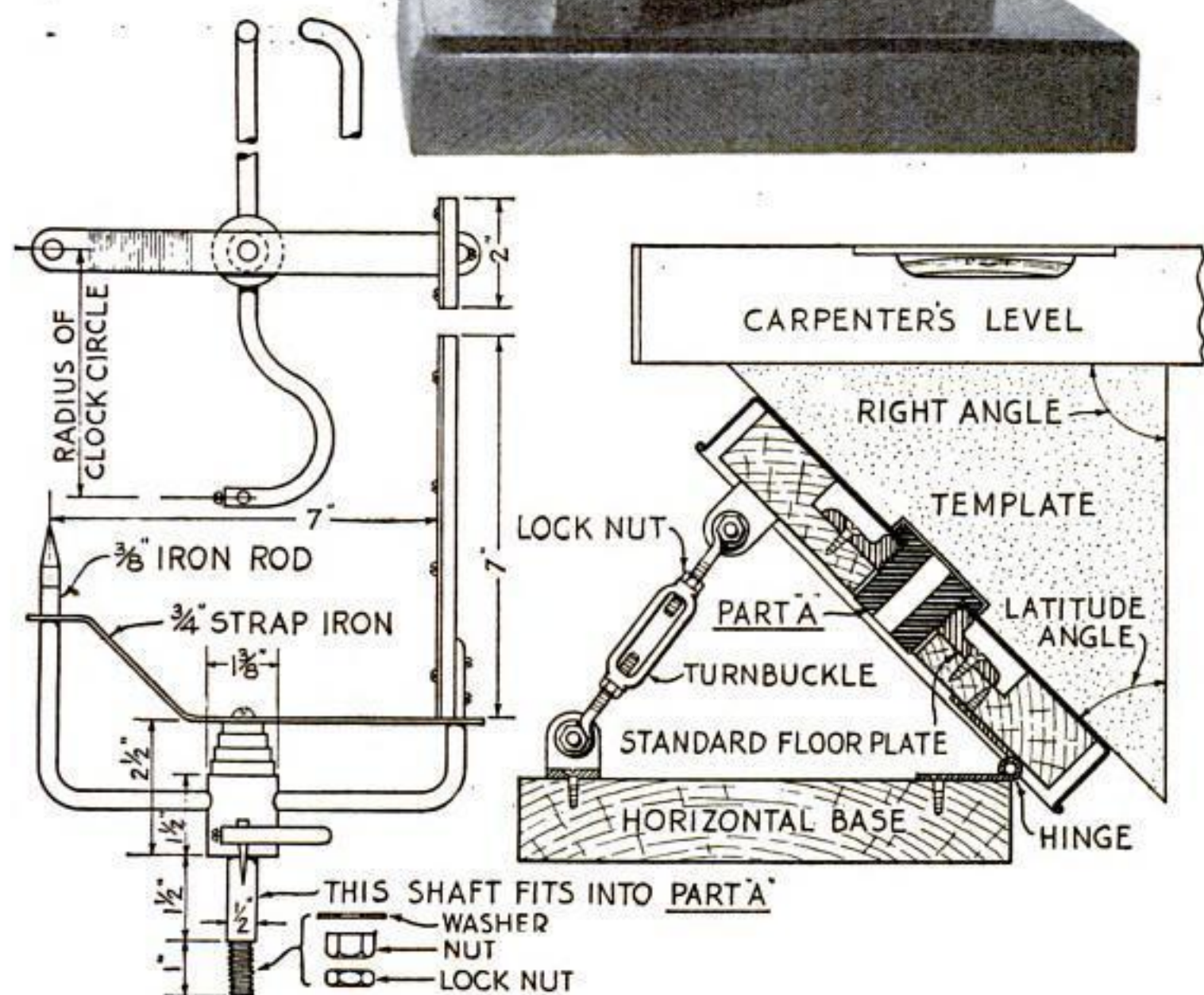
until the shadow of the point P falls on the curve; then the indicator T will be pointing to the correct standard time on the graduated dial or clock face.

This sundial is easily constructed, and the materials should not cost more than a dollar and a half.

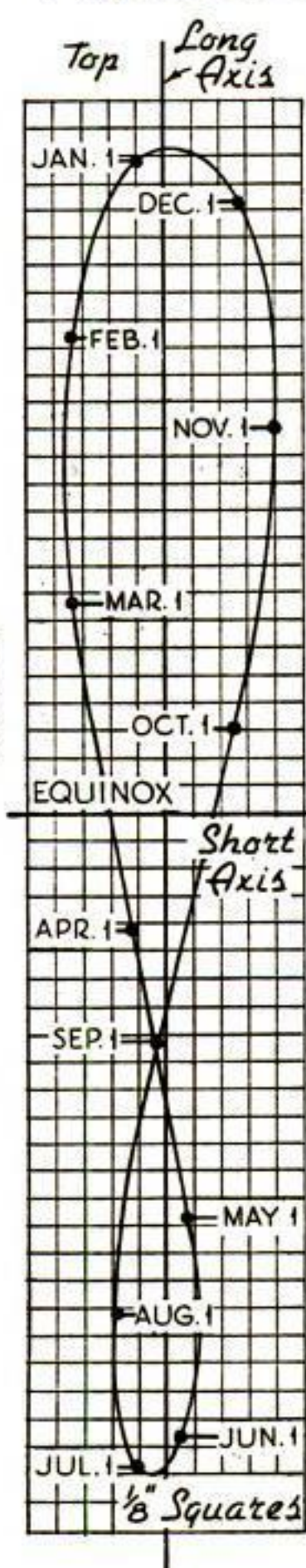
You will note that this sundial is neither horizontal nor vertical. Its axis is set up parallel to the earth's axis, as explained later, and the point P revolves about the axis of the sundial just as the sun apparently revolves about the earth. As the clock face lies in the plane of this revolution, one hour will be represented by one twenty-fourth of its circumference.

The figure-8 curve is called an analemma and is the feature in the design that incorporates the other two apparent motions of the sun. The proper curve, for the sundial described by the drawings, has been graphed for you so that no calculations are necessary. The values plotted along its long axis represent the sun's declination, or distance north or south of the equator at various times of the year. The short-axis values represent the equation of time, or the number of minutes the sun is ahead of, or behind, standard time on a certain date.

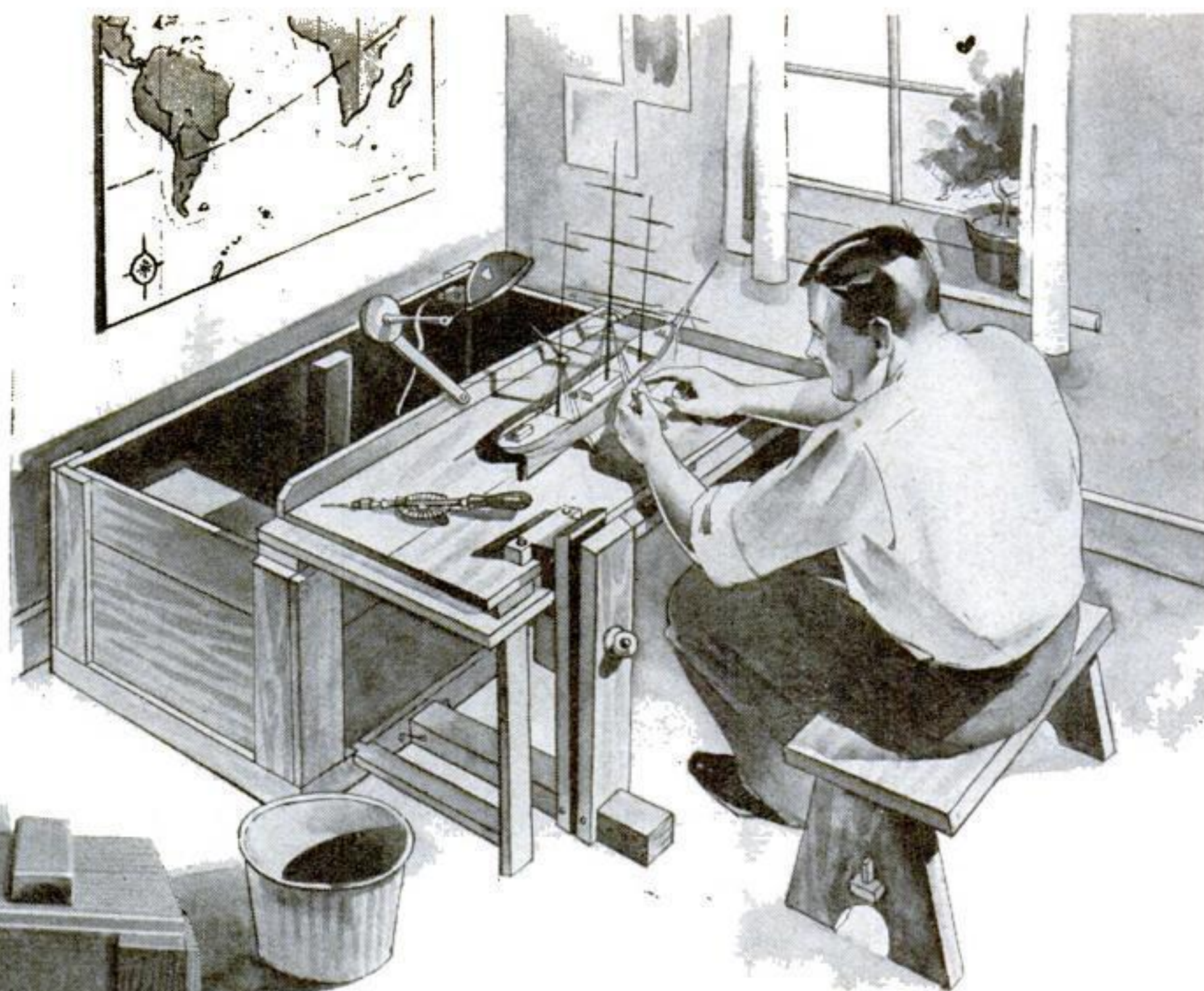
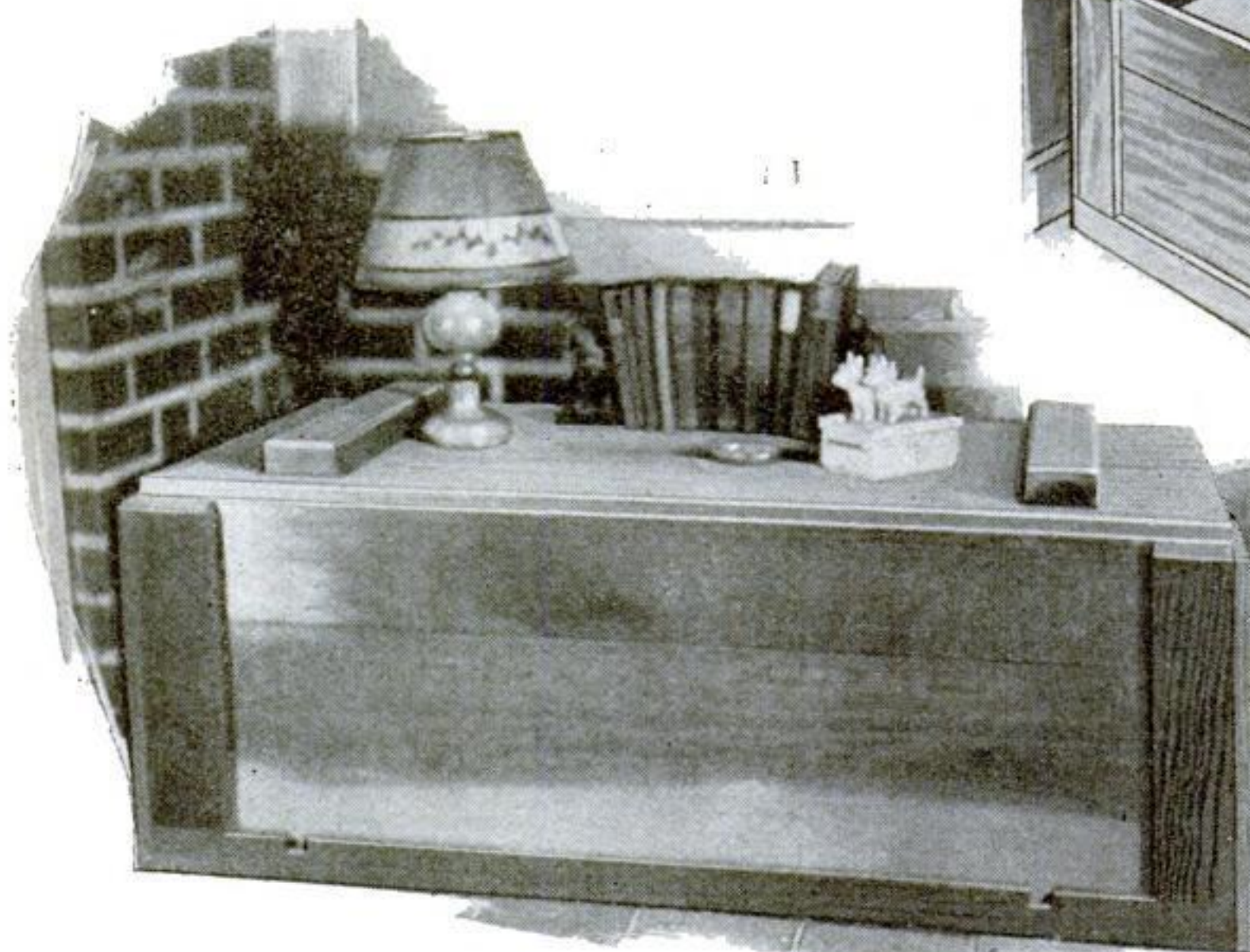
The analemma on the original model was engraved on a piece of phenol-formaldehyde composition and backed with a piece of cold-rolled steel. It may be etched on copper or steel, or merely inked on a card and varnished over. Include the axes, when you copy the curve, as you will need them in the assembly. The point *(Continued on page 120)*



Details of construction and way in which template and level are placed to set up correct latitude angle. Right, the date curve



Small Workshop Concealed in a Chest



When closed, the chest appears as at the left, but it opens out to form a complete bench as illustrated above

FOR apartment dwellers and others who have no facilities for the conventional basement workshop, this chest or window seat provides a satisfactory solution. Although designed primarily for model making, it can readily be adapted to serve many of the purposes of a full-size workbench. It may be placed in a spare room, on an inclosed porch, or in almost any available space.

Essentially, the workbench is a large

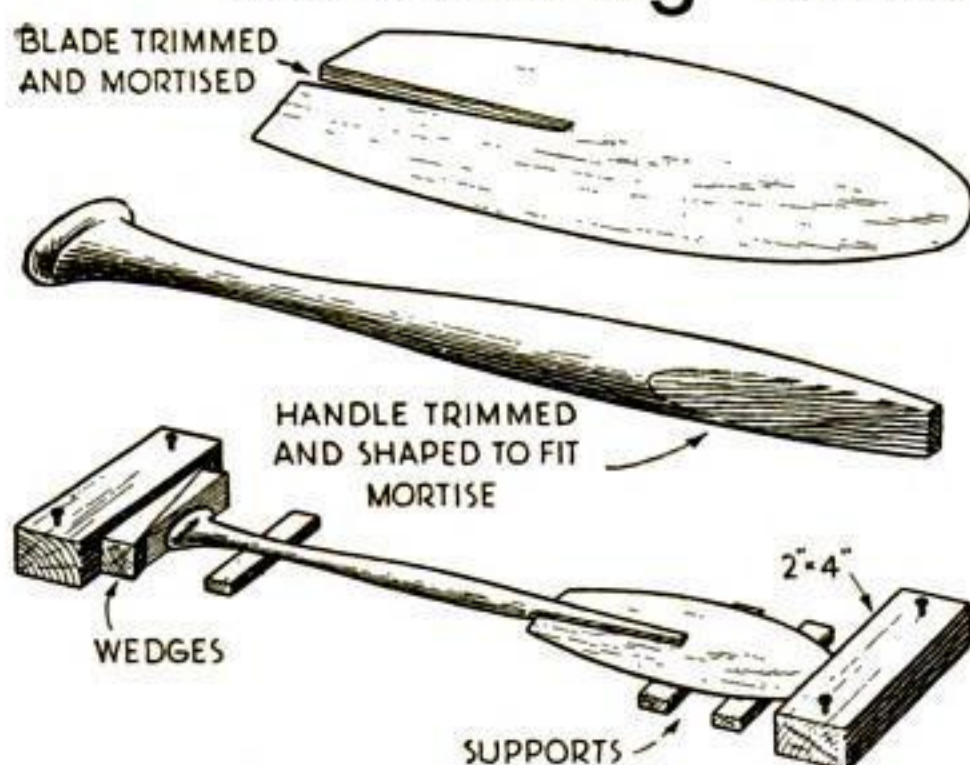
box with a hinged lid, which is supported in the open position by folding legs. The inside of the lid is covered with 1-in. hardwood to give a good working surface. Tools, materials, and paints are stored inside the box.

The size is left to the individual, but the chest illustrated is approximately 50 in. long, 24 in. wide, and 20 in. high. In the open position, this gives a working surface of about 18 by 44 in.

A vise for holding large work is bolted to the bench near one end, with a horizontal piece at the bottom that hooks onto the box. This arrangement makes it possible to dismantle the vise and store it inside. A machinist's vise with a swivel base is mounted at the other end of the bench so that it may be swung clear to permit closing the lid.

Tool racks are arranged conveniently around the inside walls of the box, and there is a shelf at one end for small tools and hardware. The box has a plug-in receptacle and a cord running to an electric outlet for supplying current to a light over the bench and also for operating small power tools and hand grinders.—ROBERT S. NEWHALL.

Reclaiming Broken Canoe Paddles



ing pieces were shaved off with a draw-knife, and the blade itself was planed a little thinner at the tip and edges. A good sanding, followed by a shellac filler and two flowing coats of marine varnish, completed the job, which has lasted for five summers.—JACK HAZZARD.

Discarded Cold-Cream Jars Hold Glue and Cement

SMALL, empty cold-cream, shaving-cream, or similar jars, fitted with metal screw tops, make satisfactory containers for glue, rubber cement, cellulose cement, and other mixtures used in the home workshop. Drill a hole in the lid for the metal-bound brush, which can be soldered in place. In case the lid is aluminum, however, use cellulose cement.—G.S.G.



Old Tire and Carpet Make Bed for Dog



Two thicknesses of carpet stretched over an old auto tire will form a comfortable dog bed. The carpet is tied underneath with cords running diagonally from corner to corner, and nailed to the tread with flat-headed nails at other points, as shown.—ESTHER F. HAYDEN.

Shop Buffer Polishes Shoes

A 4-IN. or smaller buffer, made from old woolen cloth or a discarded sweater, will polish shoes quickly and perfectly if driven at a slow speed on a shop grinding head or attached directly to a motor.—CARL GOBRICK.

NEEDING two short canoe paddles to teach children how to paddle, I rummaged around in the canoe house until I had found the blades of two broken paddles and several different handles. I took these home and sawed a 12-in. long mortise out of the spine of each blade, 1½ in. wide at the throat, and ¾ in. wide at the deepest point. A fine-toothed saw was used for this.

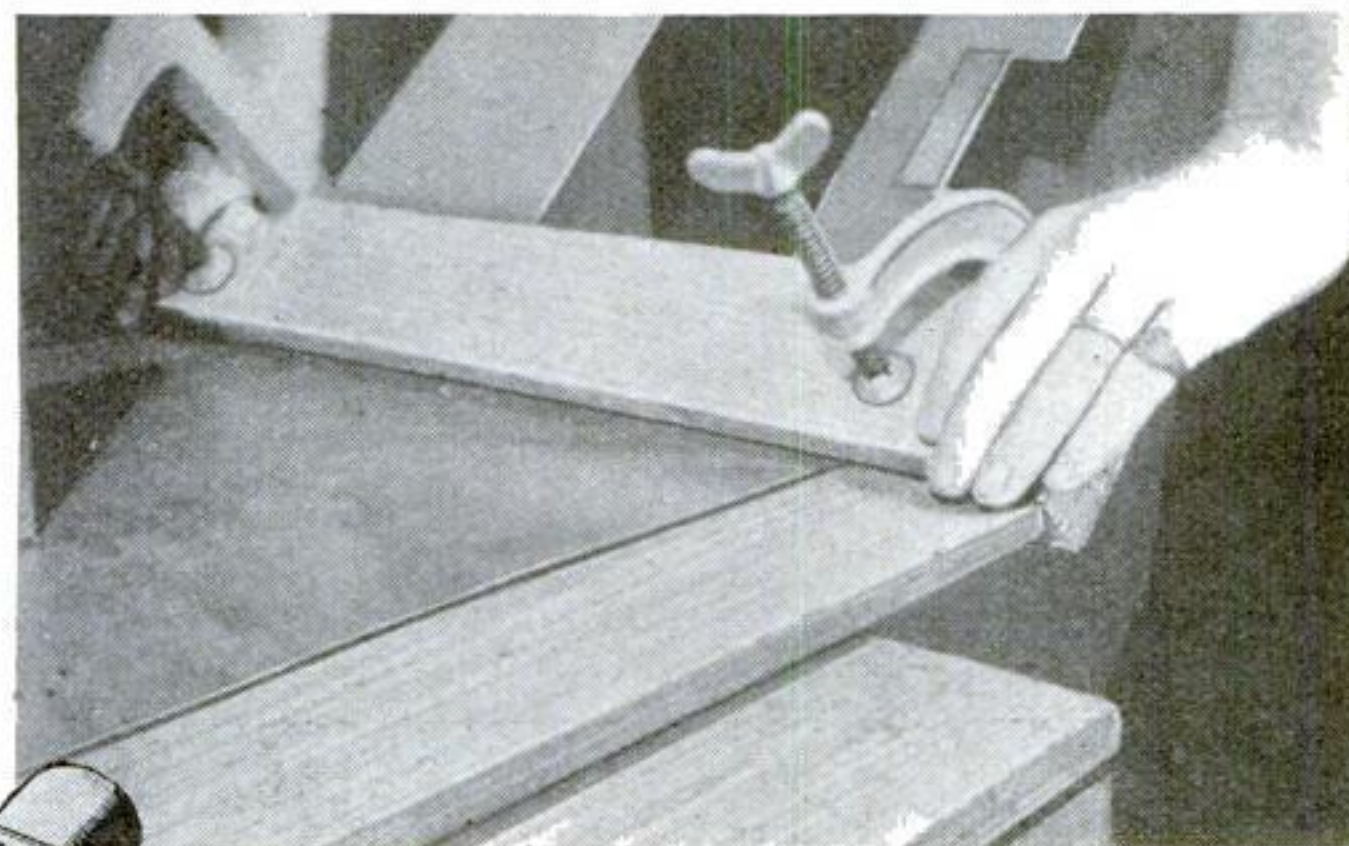
The shape of the mortise was then marked on each handle, which was planed and sandpapered to a light-tight fit. A heavy mixture of casein glue was applied, and the parts were clamped as shown. A day or two later, the project-

Tent Stove

FOR CAMPING IN CHILLY WEATHER



Setting up the stove, which is used for cooking and baking and also heats the tent. A bed of stones covered with sand or dry dirt is required only if there is a canvas floor



Bending the sides into shape. The metal is clamped between strips of wood along the line

A LIGHTWEIGHT, portable tent stove for late fall or winter hunting trips may be made in the home workshop for a fraction of the cost of even the two-burner gasoline stove so common today.

The dimensions are somewhat dependent upon the size of the tent. The smallest practical size, for a small tent and party of two, is about 10 by 12 by 18 in., while the largest should not exceed 14 by 18 by 36 in. The necessary 3- or 4-in. diameter pipe may be purchased in 2-ft. sections for the larger sizes and in 1-ft. sections for the smaller ones.

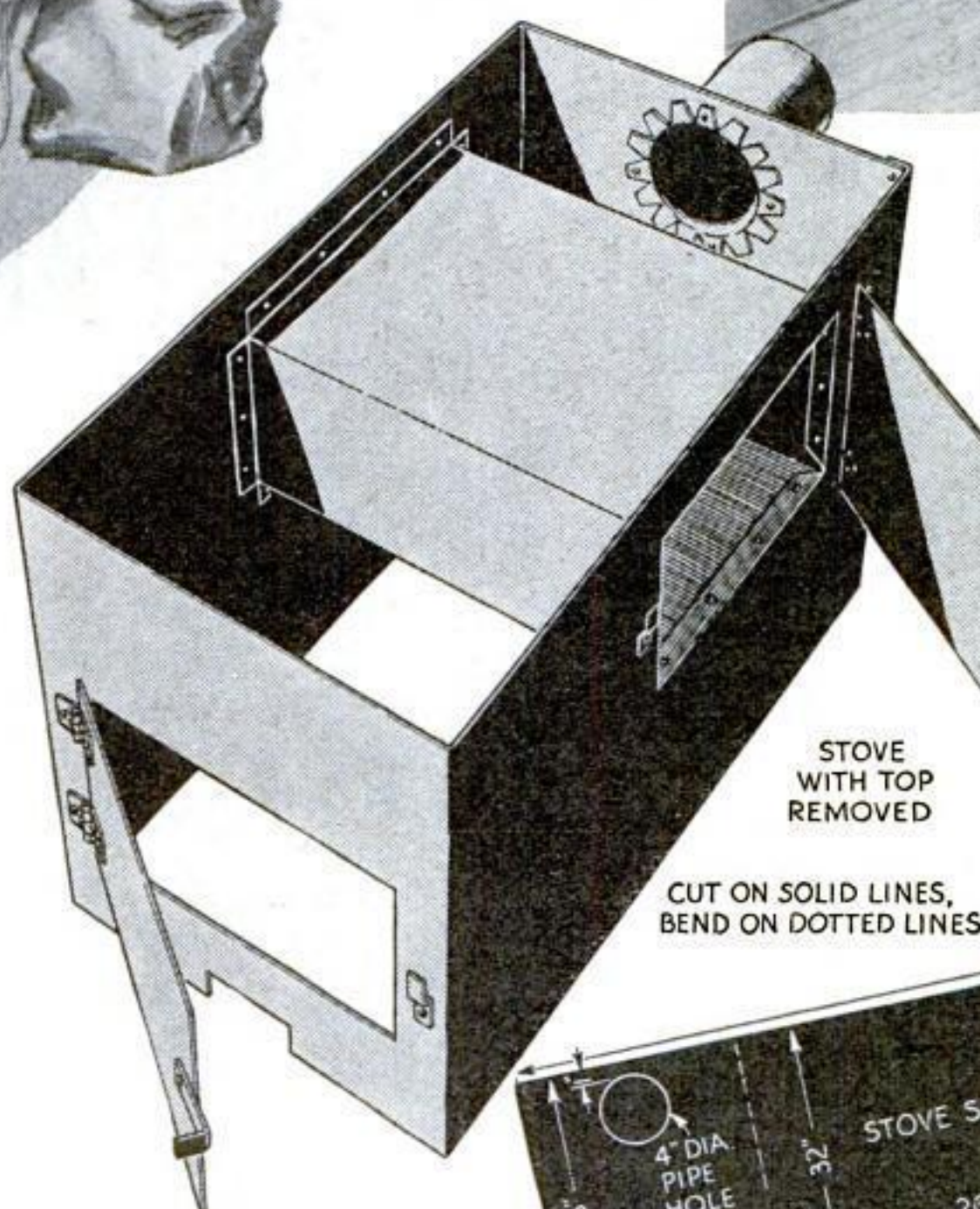
The stove to be described is designed to heat a tent about 10 by 12 ft. and for use by a party of four or five.

Materials required are as follows: Black sheet iron—1 pc. 16 by 80½ in.; 1 pc. 15 by 27 in.; 1 pc. 15 by 36½ in.; 1 pc. 8 by 12 in.; 1 pc. 7 by 12 in. Four light butt hinges. Soft iron rivets not over ¼ in. long. A sheet of zinc or bright tin about 14 in. square for the tent flashing. A small piece of fine mosquito-wire netting for the spark arrester. Sufficient 4-in. stovepipe to carry smoke above tent ridge.

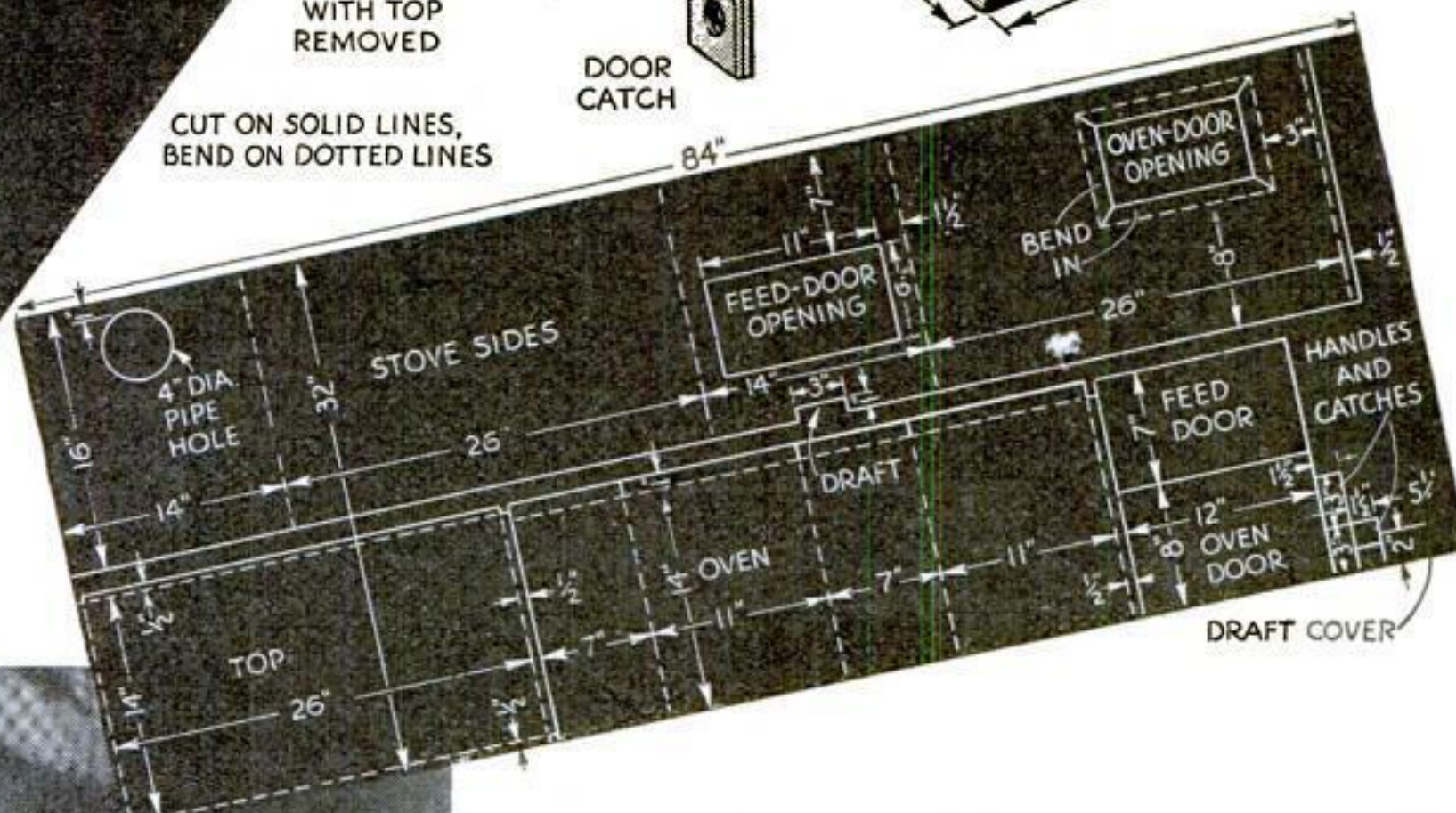
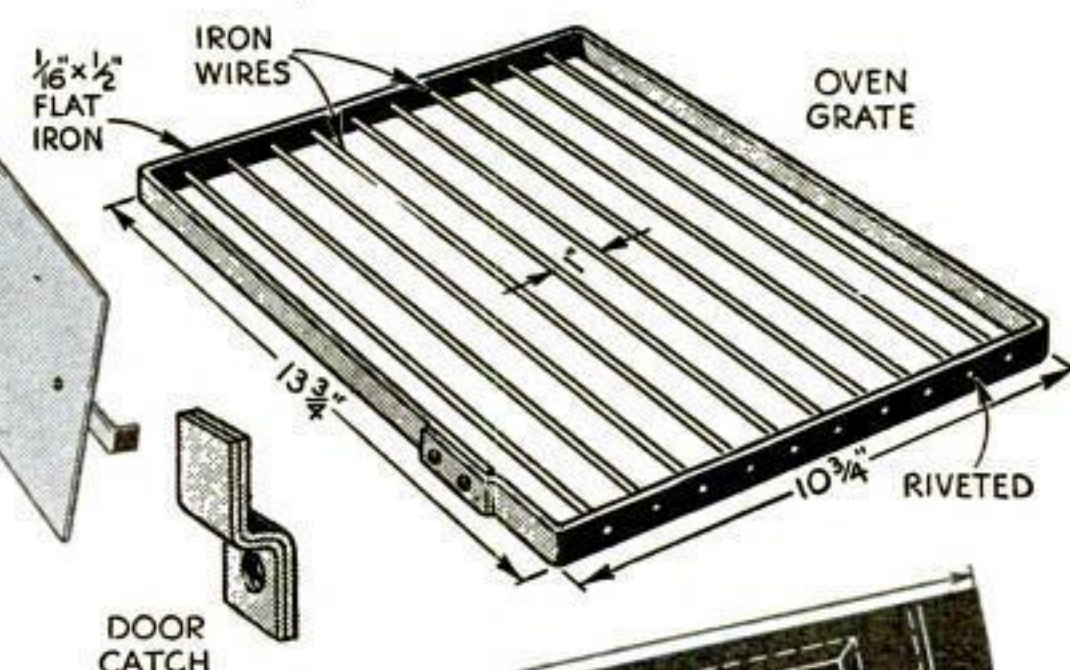
Lay out the large piece as shown. Care should be used in cutting the door openings so that the metal will not bend or wrinkle.

Fold the oven piece on the dotted lines. Use small clamps to hold together the edges with the ½-in. lap, and drill six rivet holes 2 in. apart along the seam. The 1-in. laps at the end of the oven are bent outward and are to be fastened to the side of the stove, which forms the back of the oven.

The 1-in. laps left in the oven-door opening are now bent at right angles to the sheet, and the oven is slipped into



Before the top is added. Right, layout and sketch of grate needed for oven



The stovepipe flashing is riveted in a sort of pocket sewn into the tent

place outside of the lap pieces. Rivet the oven to the lap. Laps bent in the direction shown will make the oven door come on the right-hand side of the stove. If a left-handed stove is wanted, bend the laps in the opposite direction.

To the stovepipe opening rivet a nipple made from the small end of one length of stovepipe by cutting it off 1 in. below the bead. Slit the pipe up to, but not into, the bead, making the slits about ¾ in. apart. Slip the nipple into the opening from the side opposite the oven; then bend the tabs back and rivet in about four places.

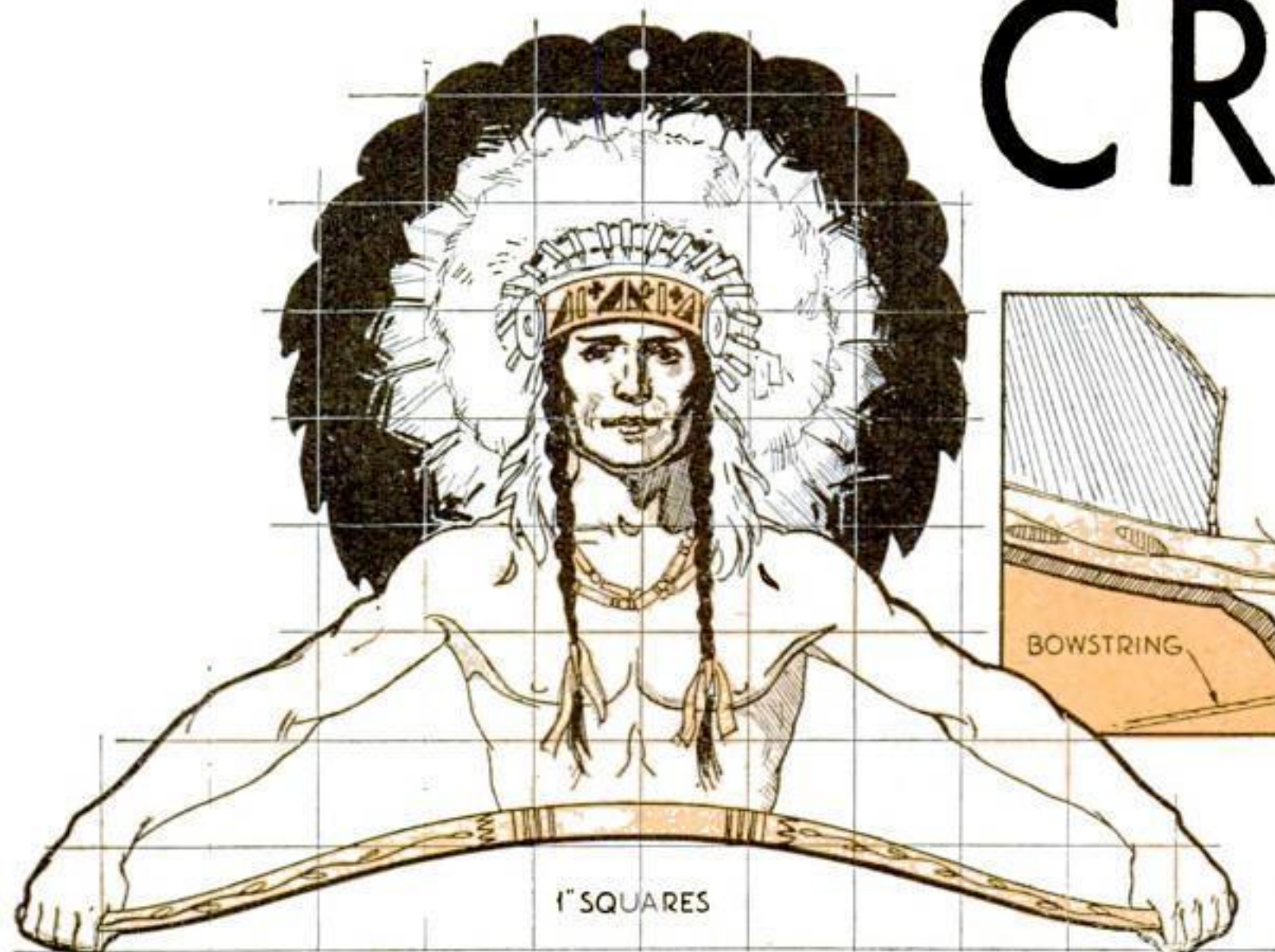
Bend the stove into shape and rivet the lap, spacing the rivets 2 in. apart.

The back end of the oven is now riveted. Cut the doors to size and rivet one pair of hinges to each.

From scraps of the iron, cut two pieces 1½ by 3 in. and fold lengthwise into strips ½ in. wide and 3 in. long. Drill one hole in each strip slightly larger than the rivets used and ½ in. from the end. Bend ½ in. (Continued on page 121)

By **LEONARD F. MERRILL**

CRAFTWORK



Indian with a Bow Forms Colorful Necktie Rack

KEPT in a drawer or carelessly hung on a coat hook, neckties have a bad habit of wrinkling, but a bowstring tie rack like that illustrated is an insurance against this and an inducement to any boy to put his ties away neatly.

Use a smooth piece of $\frac{1}{2}$ -in. white pine, free from knots. To make a full-size pattern, draw 1-in. squares on a sheet of paper 9 by 12 in., and copy the Indian figure, square by square. Transfer the outline to the wood and cut it out carefully. Carve down the background between arms and bow, and also the sides of the body, so that these parts are lower than the rest of the figure.

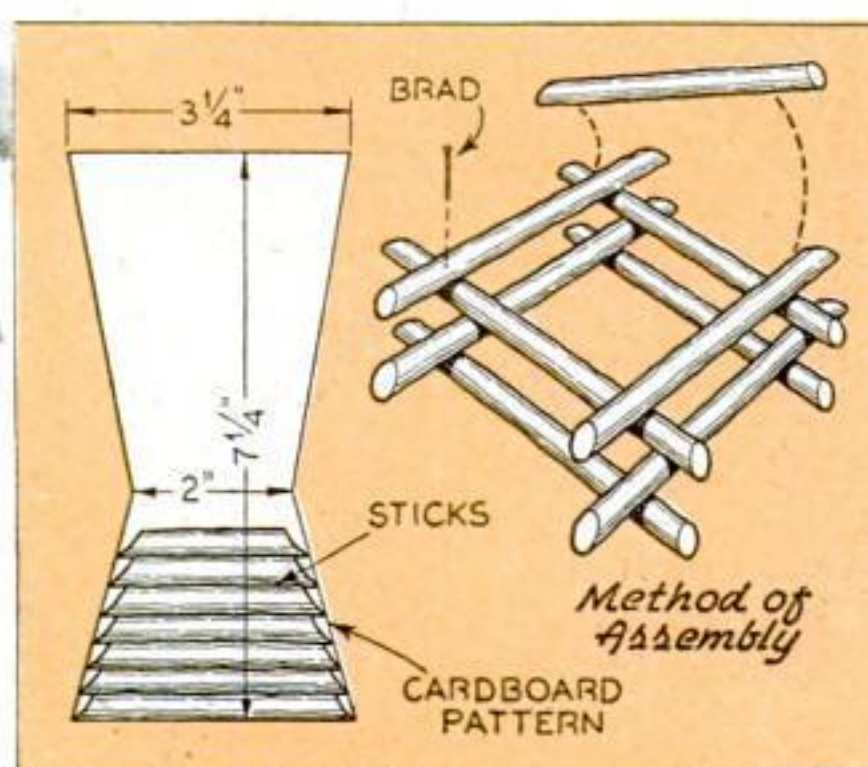
Insert one small screw eye into each

hand from below and run a strong cord from one to the other, fastening it on the back with a knot. On this bowstring the ties are hung. The cord should be pulled as tight as possible. A hole is drilled near the top of the Indian's headdress for hanging the rack on a closet door or in any convenient place.

Paint the Indian a reddish brown; the bow, yellow and red; the brow band, any suitable colors such as white with a blue and red design; medium shadows on the face and body, dark brown. The dark shadows may be black or nearly



so, and the hair and the tips of the feathers should be black. Between the tips of the feathers and the white, paint a light blue edge. The wrappings on the feathers are red; the ribbons on the braids, green or red. The background between the arms and the bow should be a sky blue. A little red on the lips and a dash of white in the eyes will add a lot of life to the whole Indian figure.—GRAY WOLF.



The finished basket and how the sticks are cut over a pattern and assembled

Rustic Flower Basket Made from Small Willow Sticks

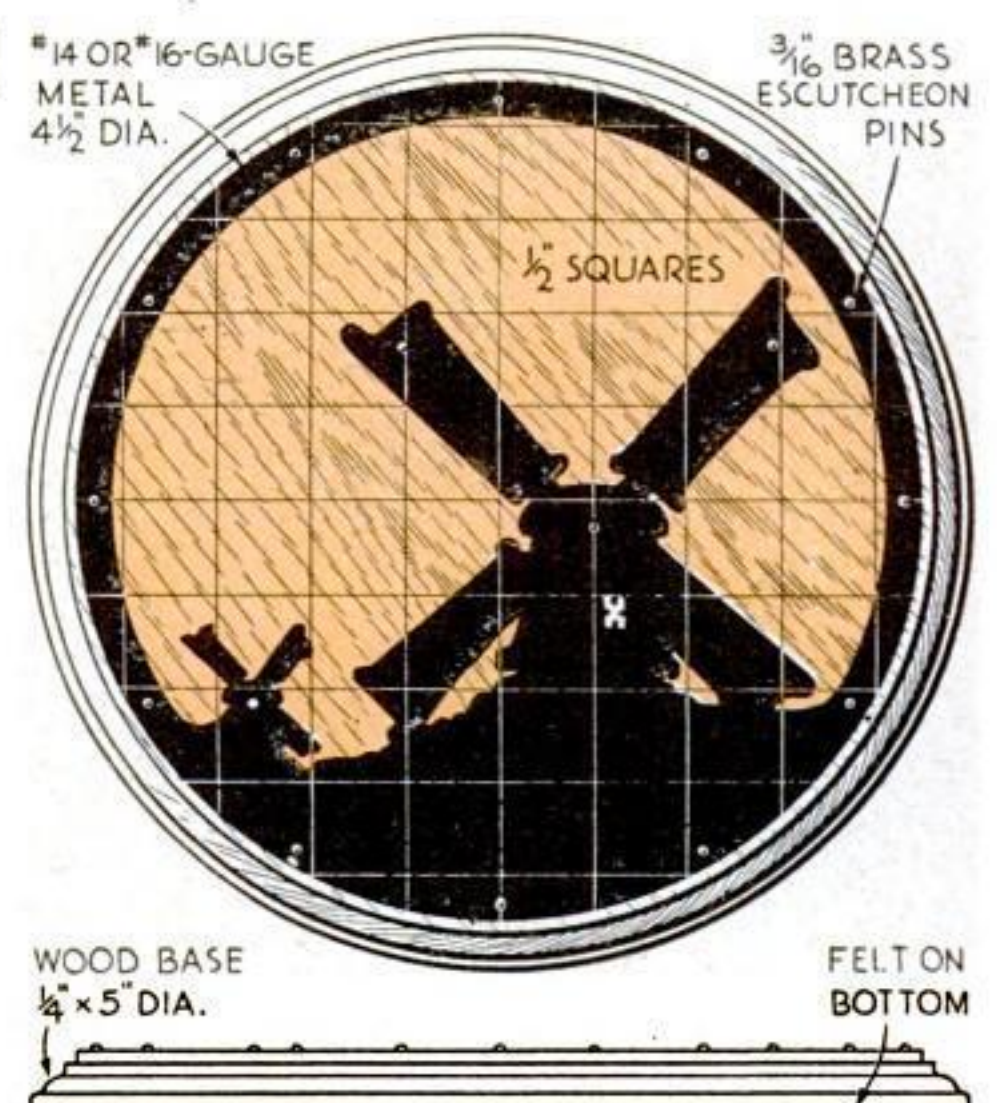
A FEW willow sticks, a sharp knife, and some small brads are the only materials needed to make this rustic basket for artificial flowers. Willow sticks can be cut along many streams and country roads. They are used while green. Sticks from $\frac{1}{4}$ to $\frac{3}{8}$ in. in diameter are chosen for the crosspieces, and slightly smaller ones for the corner sticks and handle.

The crosspieces are cut according to a cardboard pattern, as shown. The cardboard must be completely covered twice to provide *(Continued on page 123)*

Dutch Windmill Silhouetted on a Tea Tile

DESIGNED to protect the table top against hot dishes, this so-called "tea tile" consists of a windmill silhouette cut from 14- or 16-gauge aluminum (brass or copper also may be used) and mounted on a walnut base.

Draw the pattern on thin paper and cement to the metal with thin shellac or any available adhesive. Cut out the design with a jeweler's saw or similar fine-toothed jig saw; then clean the metal with denatured alcohol, and remove any large scratches with fine emery cloth. Polish with oil and whiting, polishing rouge, or other fine abrasive. Drill $\frac{1}{32}$ -in. holes for the escutcheon pins.

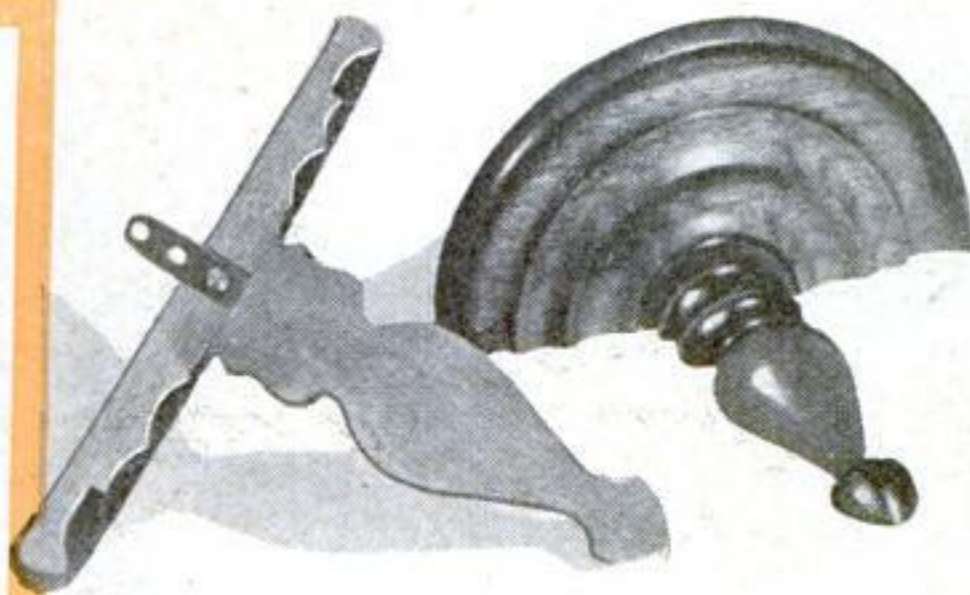
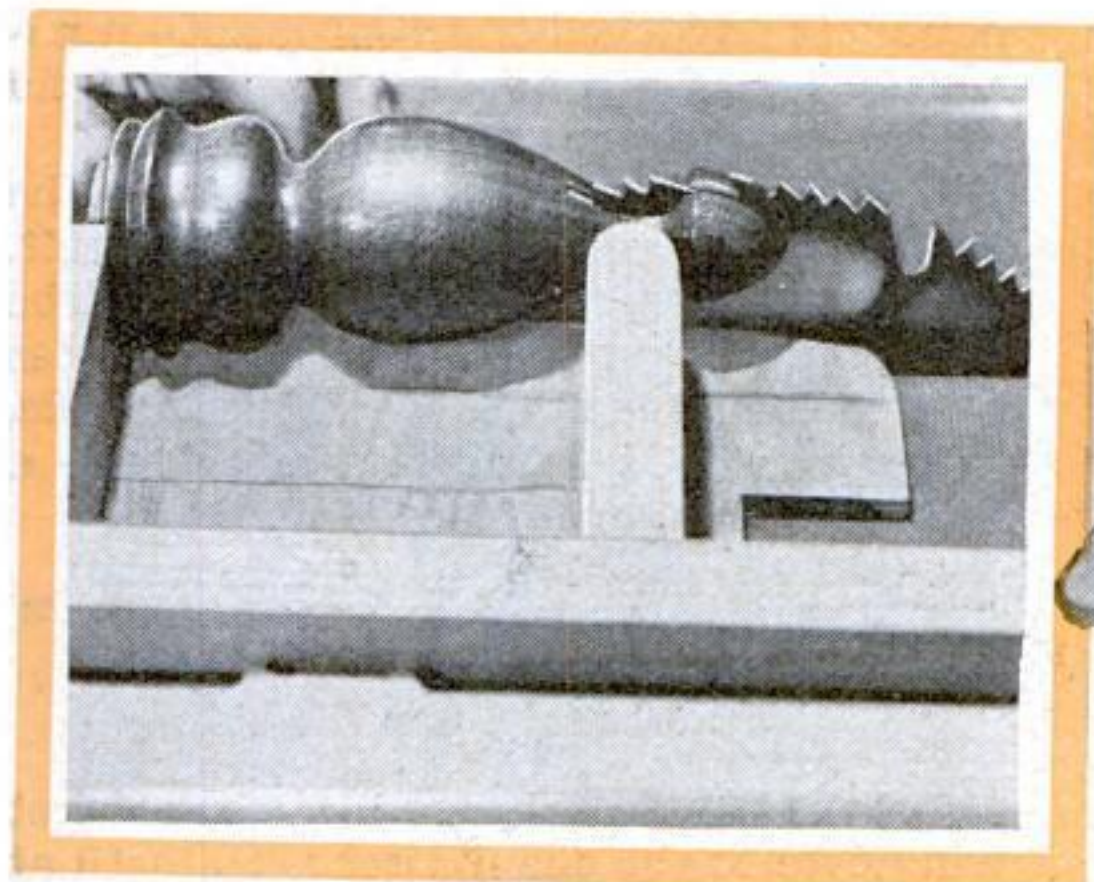


The windmill design is cut from thin metal and fastened to a base turned from walnut

Turn the base in the lathe, shaping the edge as indicated or to any design desired. Stain, fill, and varnish the base, and attach the metal with $\frac{3}{16}$ -in. escutcheon pins. Glue felt to the bottom.

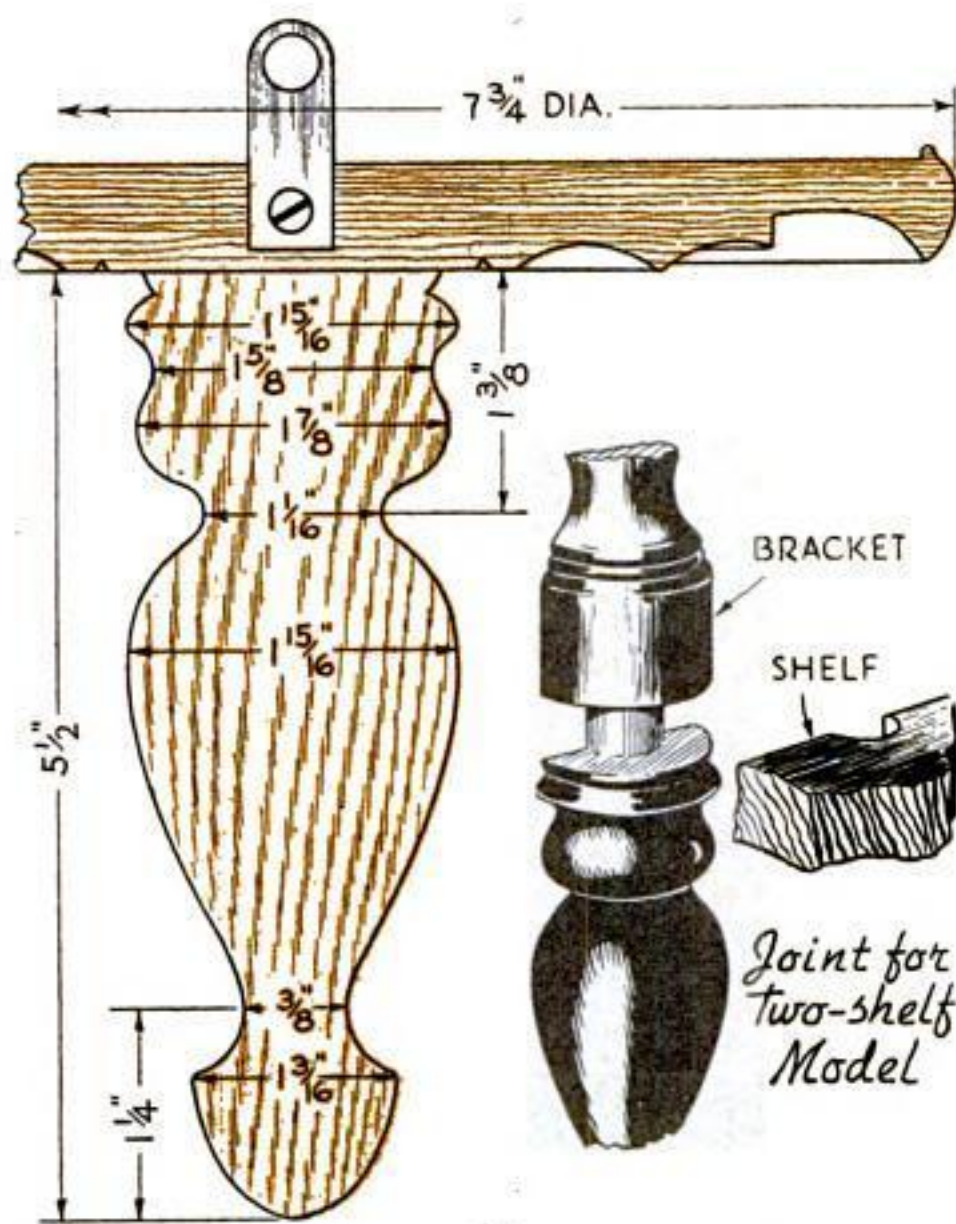
Similar designs of Dutch girls, tulips, and the like can be drawn and made into tiles the same way.—F. CLARK HUGHES.

FIVE ATTRACTIVE NEW DESIGNS YOU CAN WORK OUT FROM INEXPENSIVE MATERIALS



The pieces are wood turnings, sawed in half. If a circular saw is used, a cradle is made to protect the bracket from being marred, as shown at the left

Twin Shelves Tack up on Wall



Suggested dimensions and method of making the lower joint if an extra shelf is added

SMALL twin shelves, made from turned parts as shown, look equally well on one wall or balanced on either side of a door, window, or fireplace. A pair can easily be made in two hours, and the two pieces of walnut or other hardwood needed are only 1 by 8 by 8 in. and 2 by 2 by 6 in.

This is entirely a lathe project as both pieces can be turned, sanded, filled, and French polished while revolving. The shelf is a faceplate turning. Use only one screw through the center of the faceplate to attach it. Turn the top and the edge, leaving a small bead to form a rail around the shelf. Remove the shelf and fasten the opposite side to the faceplate in the exact center; then complete the turning and sandpaper it.

The bracket is turned between centers. Cut the bottom end quite small so as to not to leave any unpolished wood when this is cut in half. If the bracket is to be cut in half on a circular saw, build a cradle to guide and protect it, otherwise it may be defaced by the



saw-table slot so it cannot be used.

A metal hanger is mortised into the shelf, and the bracket attached with small, blind dowels.

These shelves may be made in many patterns and sizes. Models with two and three shelves are likewise attractive, the joints being made as sketched. Turn the entire length of bracket in one piece, cutting deeper at places where the shelves are to fit.—L. A. L.

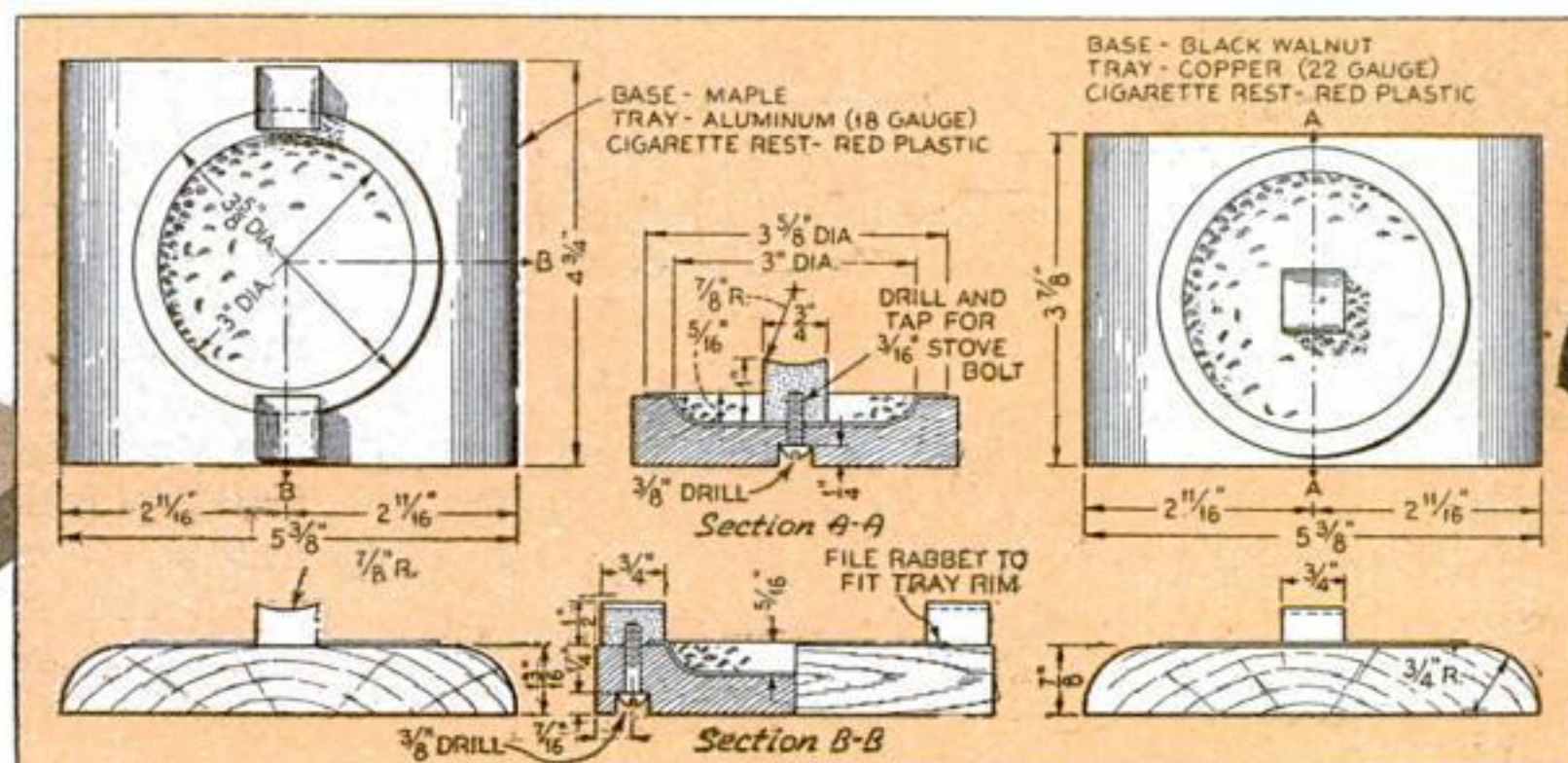
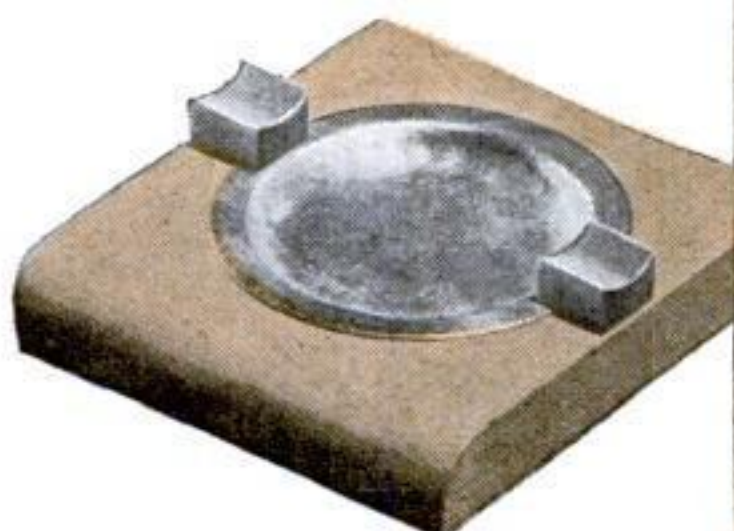
Two Colorful Ash Trays in the Modern Mode

ALTHOUGH simple in design, the two modern ash trays illustrated below are projects of which any craftsman can be proud. They make excellent gifts and look exceptionally well with modern furniture. One is of copper and walnut, the other of aluminum and maple. Both have cigarette rests of red fireproof plastic. The Fairmont (W.Va.) Homecraft Club won fourth prize for them in a contest of the National Homeworkshop Guild (see P.S.M., July

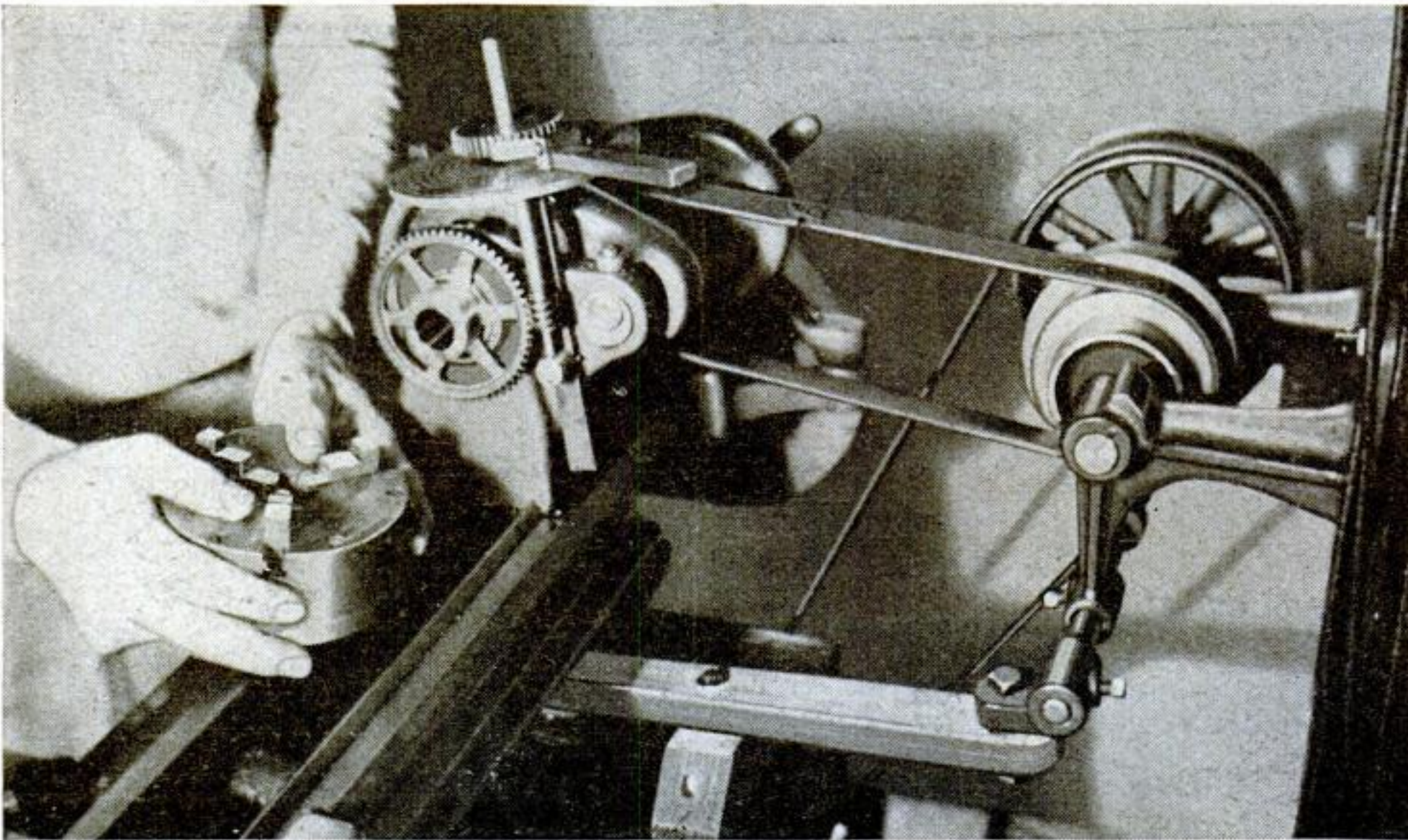
'37, p. 82). The operations for making either tray are essentially the same:

Metal Tray. Cut out disk and polish. (Anneal copper before polishing.) Hammer to shape in wood mold with mallet, planish with steel hammer, true edges with file, polish with emery cloth, and then polish with rouge on a muslin buff. A 3/16-in. hole must be drilled in the center of the copper tray.

Wood Base. Square up stock, ([Continued on page 123](#))



Simple Indexing and Dividing Head for a Lathe



This mechanism will lay out anything from table-leg fluting to astronomical circles

FOR not much more than the price of a worm and gear, one can make a universal indexing and dividing head for the lathe. The construction is based on a brass worm gear having a $\frac{3}{8}$ -in. face, $3\frac{3}{4}$ -in. pitch diameter, 60 teeth, 16 pitch, and a single-thread worm to match. The center portion of the worm gear is turned out for a close fit on the lathe spindle, where it is clamped behind the chuck or faceplate.

The worm is fitted into an assembly as shown in the drawings, the dimensions being for a small 9-in. lathe. The principal stock required is a short piece of $\frac{5}{8}$ -in. round cold-rolled steel, a 7-in. length of $\frac{3}{8}$ -in. round cold-rolled, and approximately 16 inches of $\frac{5}{16}$ by $\frac{5}{8}$ -

in. rectangular cold-rolled bar. The assembly is held with nut and lock washer through a hole in the rear of the headstock casting. An alligator-type spring paper clip is placed under the lower end of the rectangular bar.

The handle is clamped by means of its split end to the worm shaft, when indexing. Fifteen turns of the handle, to give an example, will produce a quarter turn of the lathe spindle (60 teeth \div 15 teeth = $\frac{1}{4}$ turn).

The $5\frac{1}{4}$ -in. circular disk has circles scribed on it, on one of which seven equally spaced

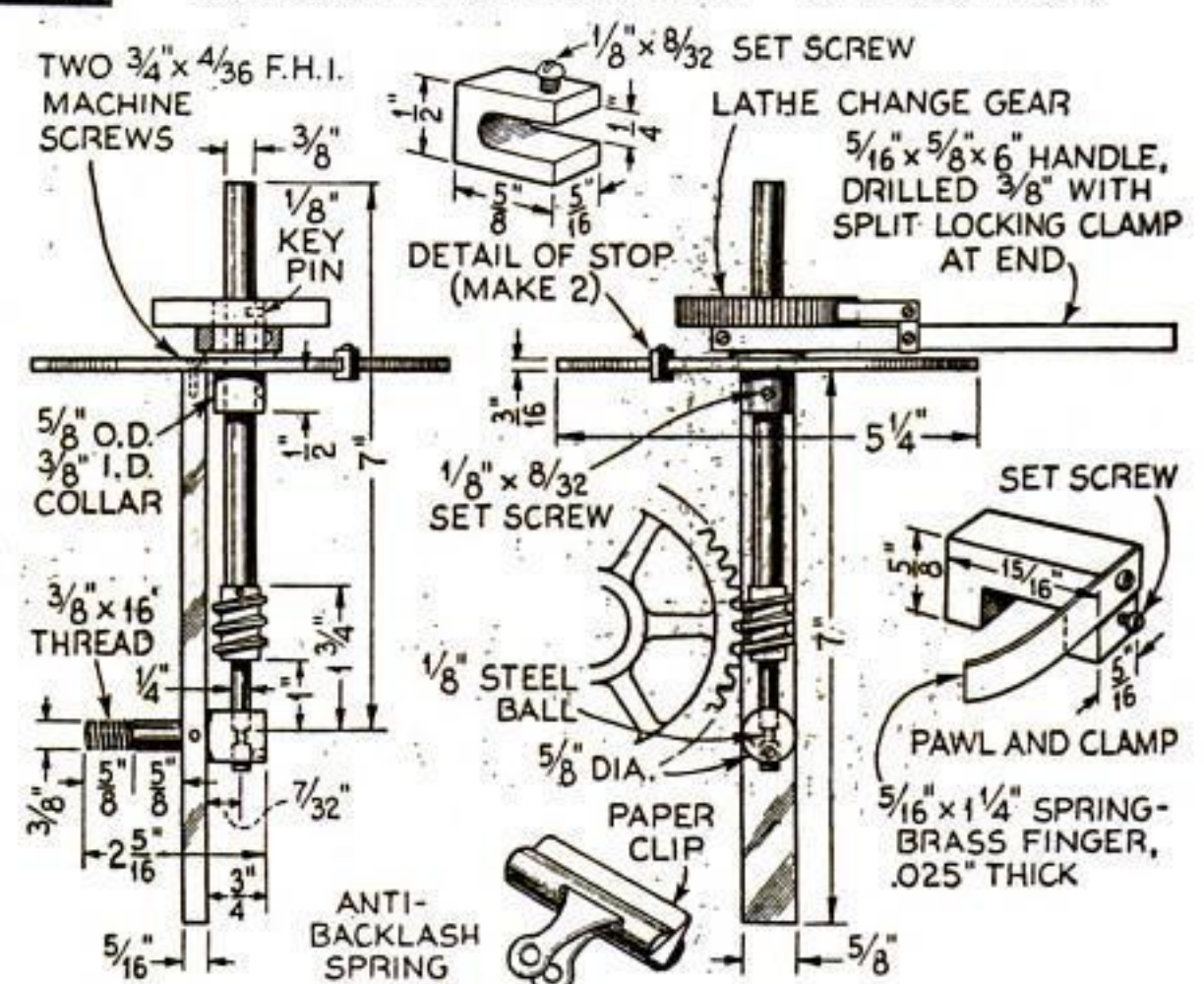
holes are drilled, on another, nine holes, and so on. To index the rotation of the spindle into these odd parts, the worm handle is advanced the appropriate number of turns plus a fraction, and held temporarily by a locating pin.

For fine dividing, one of the lathe change gears is keyed to the worm shaft, using a bushing and a $\frac{1}{8}$ -in. key pin. The handle in this case turns free and carries a ratchet of the type shown. For example, to engine-divide a 360-deg. circle, use a 60-tooth change gear:

$$\frac{60 \text{ (change gear)} \times 60 \text{ (worm gear)}}{360 \text{ divisions}} =$$

$$\frac{3600}{360} = 10 \text{ teeth per division}$$

Set the handle stops so that the ratchet will advance the change gear ten teeth at a time. A scriber on the lathe cross slide will mark the divisions—G. LAMPKIN.



The worm gear fits on lathe spindle behind chuck

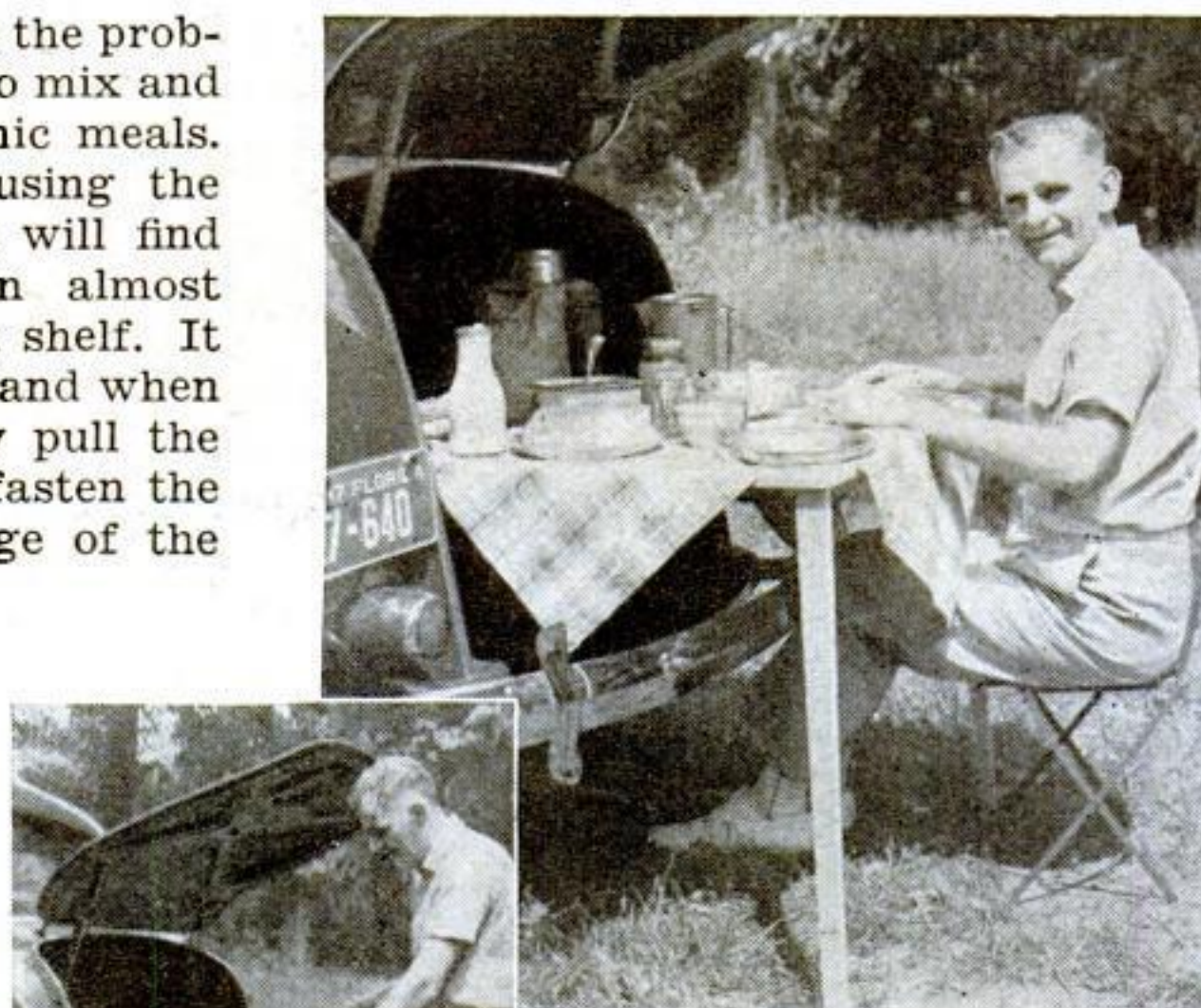
Picnic Table Extends from Auto Trunk

THIS auto trunk table solves the problem of enough table room to mix and serve food for camp and picnic meals. Motorists who are already using the trunk itself for this purpose will find that the described extension almost doubles the area of the trunk shelf. It is carried on top of the shelf, and when you are ready to eat, merely pull the table out, drop the legs, and fasten the rear corners to the front edge of the trunk shelf with two pins.

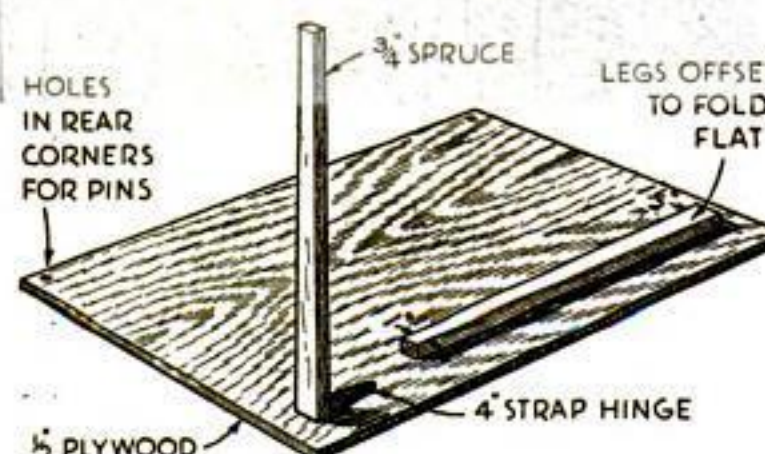
The table top is made of $\frac{1}{2}$ -in. plywood cut to fit the depth of the trunk shelf and the width of the trunk lid—in this case, $24\frac{1}{4}$ by $36\frac{1}{4}$ in. Holes $\frac{1}{4}$ in. in diameter are drilled through the top and shelf, and tenpenny nails are used for pins.

The two legs are of $\frac{3}{4}$ -in. spruce, tapering from $1\frac{1}{2}$ in. wide at top to 1 in. at bottom, and are attached with 4-in. strap hinges. Stagger the legs sufficiently to fold down alongside each other. Cut the legs slightly longer than shelf height.

Plates for three may be set on the table itself, or the table can be simply used as a serving space to hold food.—MAURICE H. DECKER.



To set up the picnic table, pull it out, drop legs, and pin rear corners to edge of trunk shelf



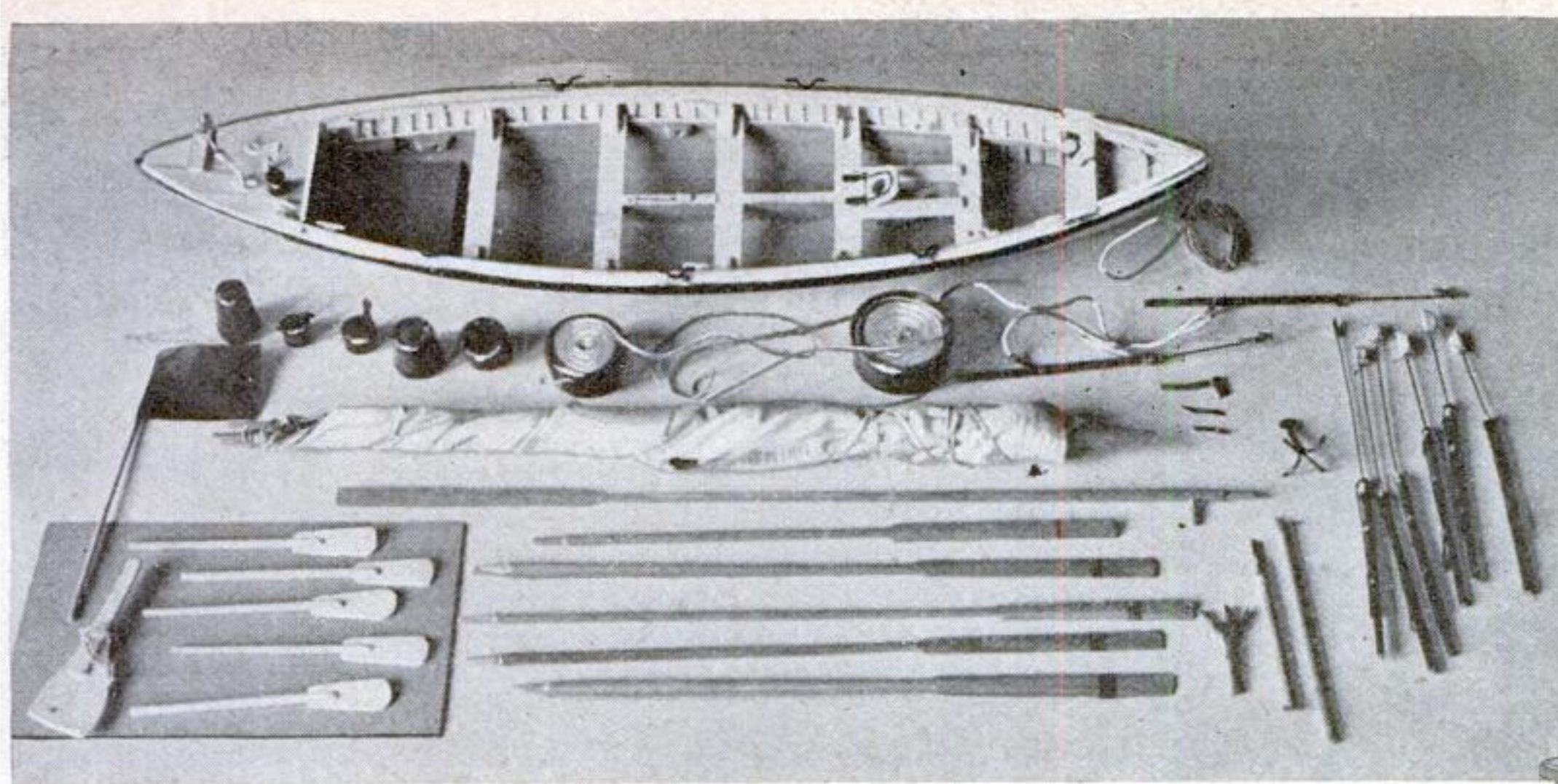
Grip the wire in your hands with the loop held in vise. Twist evenly



Camper's Toasting Fork Twisted from Wire

A GOOD toasting fork for the camp fire or outdoor fireplace can be made from a piece of No. 8 galvanized iron wire 6 ft. long. Bend it in the middle to make a loop about 1 in. wide and 3 in. long. Clamp this loop in a strong vise and twist the two ends evenly into one long piece. As the twisting progresses, move the wire along so as to keep the grip of the vise close to the hands. If the shaft needs straightening after the twisting is done, lay the work on a board and use a mallet.

At the ends leave about 4 in. untwisted to form the tines. File or grind the ends to sharp points and bend to a curve, as shown.—R. H. JENKINS.



Each fitting you make symbolizes the great adventure of whaling



Here are the harpoons, lances, oars, sails, rudder, and other fittings carried by every whaleboat

EQUIPPING OUR NEW Whaleboat Model

By Capt. E. ARMITAGE McCANN

IN THE great days of the New England whaling industry, the actual harpooning was done from thousands of incredibly stanch and efficient little whaleboats. Those of the famous New Bedford type were all alike, standardized as if they came from a factory assembling line. In fact, you could put an experienced seaman on any one of them, blindfolded, and he would be able to lay his hand without hesitation on any one of the fifty main items of equipment the

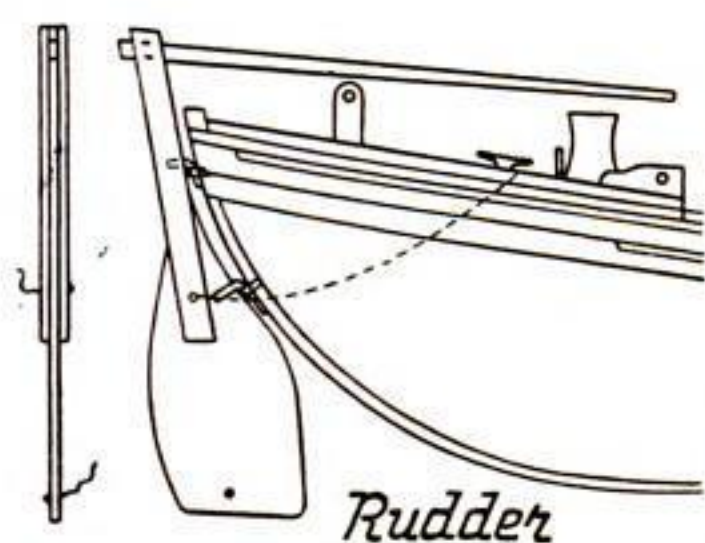
whaleboat carried. For this and many other reasons, a whaleboat is a project to appeal to all ship model makers.

If you missed the opening article in this series (P.S.M., Sept. '37, p. 104), look it up, because drawings were given for a 1/2-in. scale model of a 28-ft. whaleboat. Those readers who have already completed the hull to the point described in that article, are ready to continue with the rudder, which is shaped as shown in a drawing at the left.

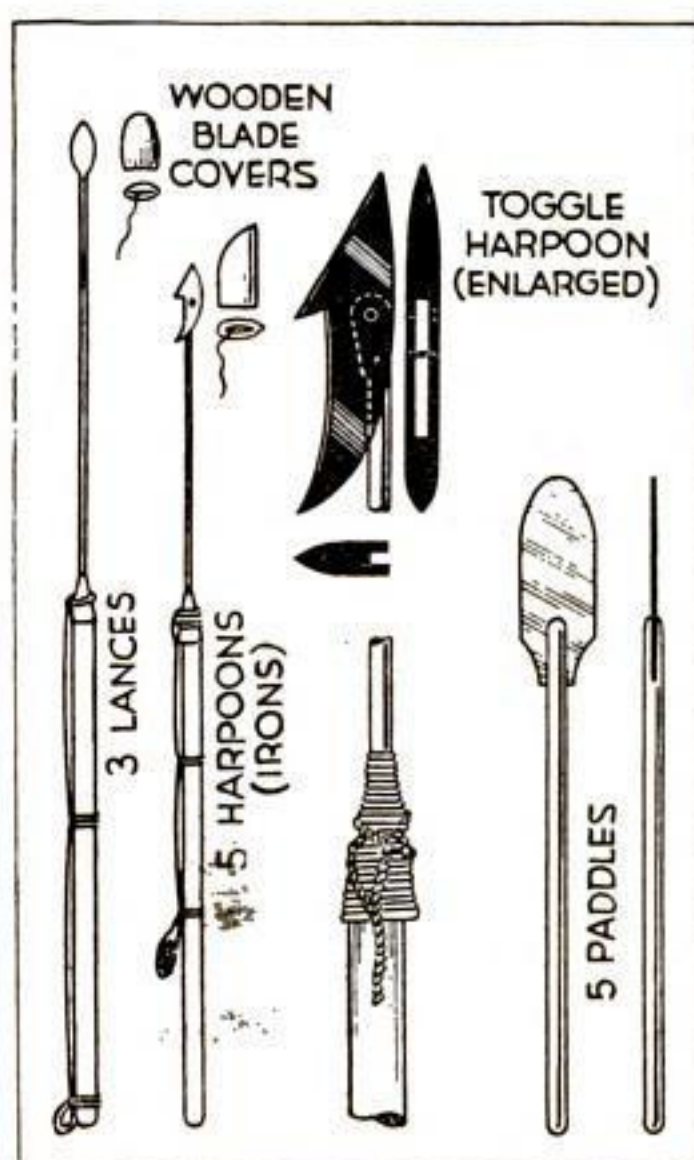
The gudgeons can be eyes made of pins; and the pintles, pins driven into the rudder and bent down, with dummy straps. The square tiller is set between the two side boards of the rudder, high enough to clear the oar brace. There are two holes in the rudder through which are threaded thin lanyards, the top one fastening to the cleat on the lion's tongue and the other to the cleat inside the gunwale, to port. The rudder is used only when sailing.

The painter is of cord similar to the whale line and about twice the length of the boat. It is spliced to a hole in the stem.

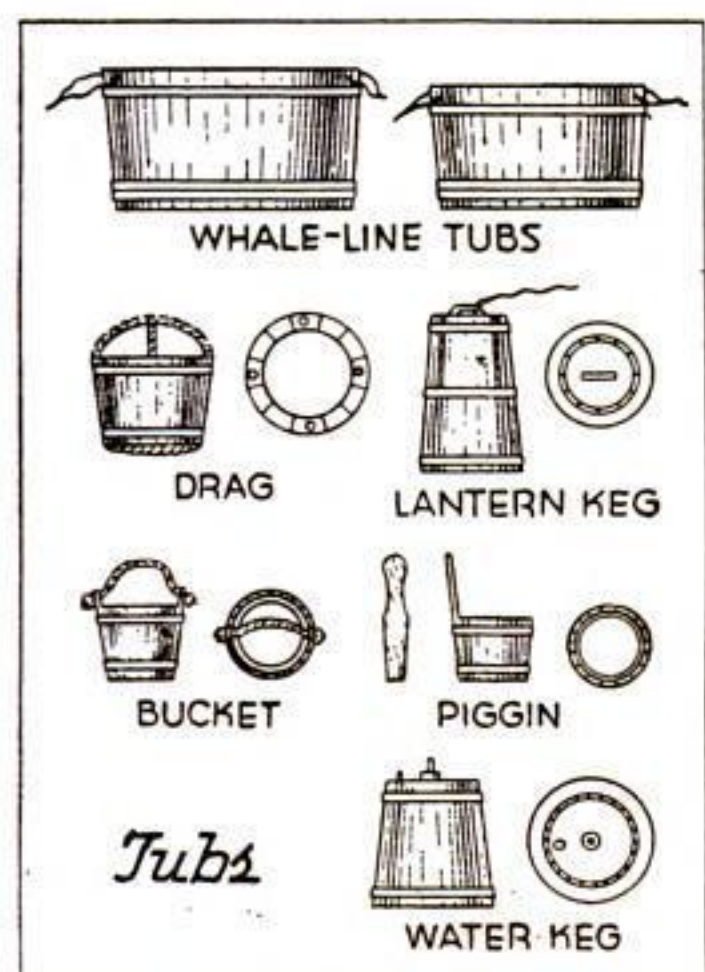
Some boats had boom-and-gaff sails, lug sails, or sprit-sails. I chose the latter rig. The real mast is 5 in. in diameter at the hinge, so on our 1/2-in. scale a 1/4-in. dowel stick will make it. It tapers to the heel and to the head, which is squared. At about 6 ft. (Continued on page 134)



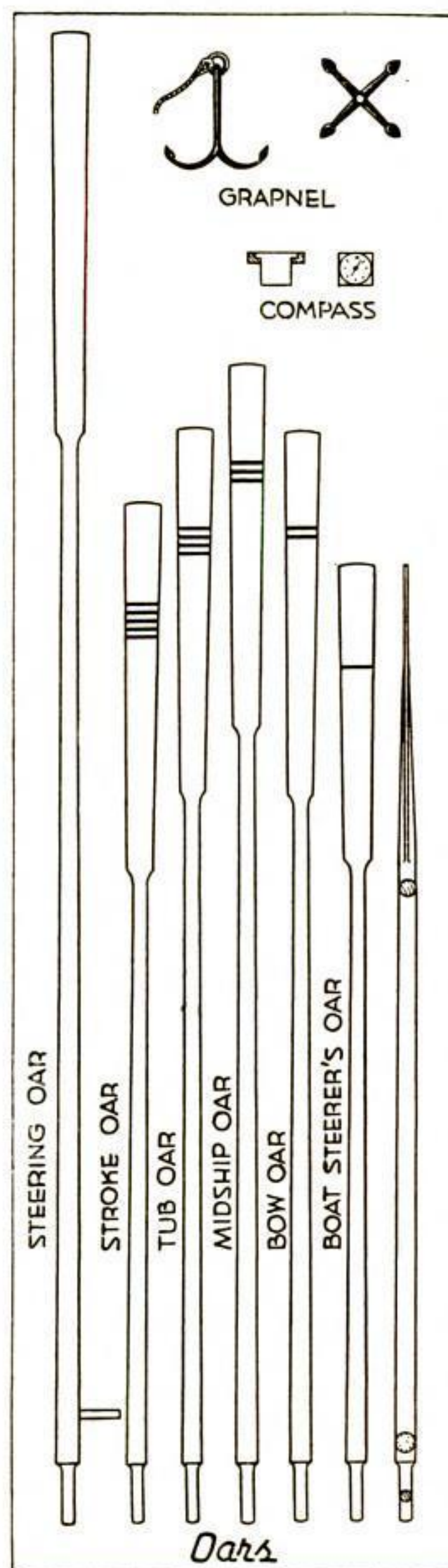
Rudder



Rudder, lances, harpoons, spades, and tubs drawn half the size you are to make them, and a much-enlarged view of the harpoon parts



Tubs



Oars

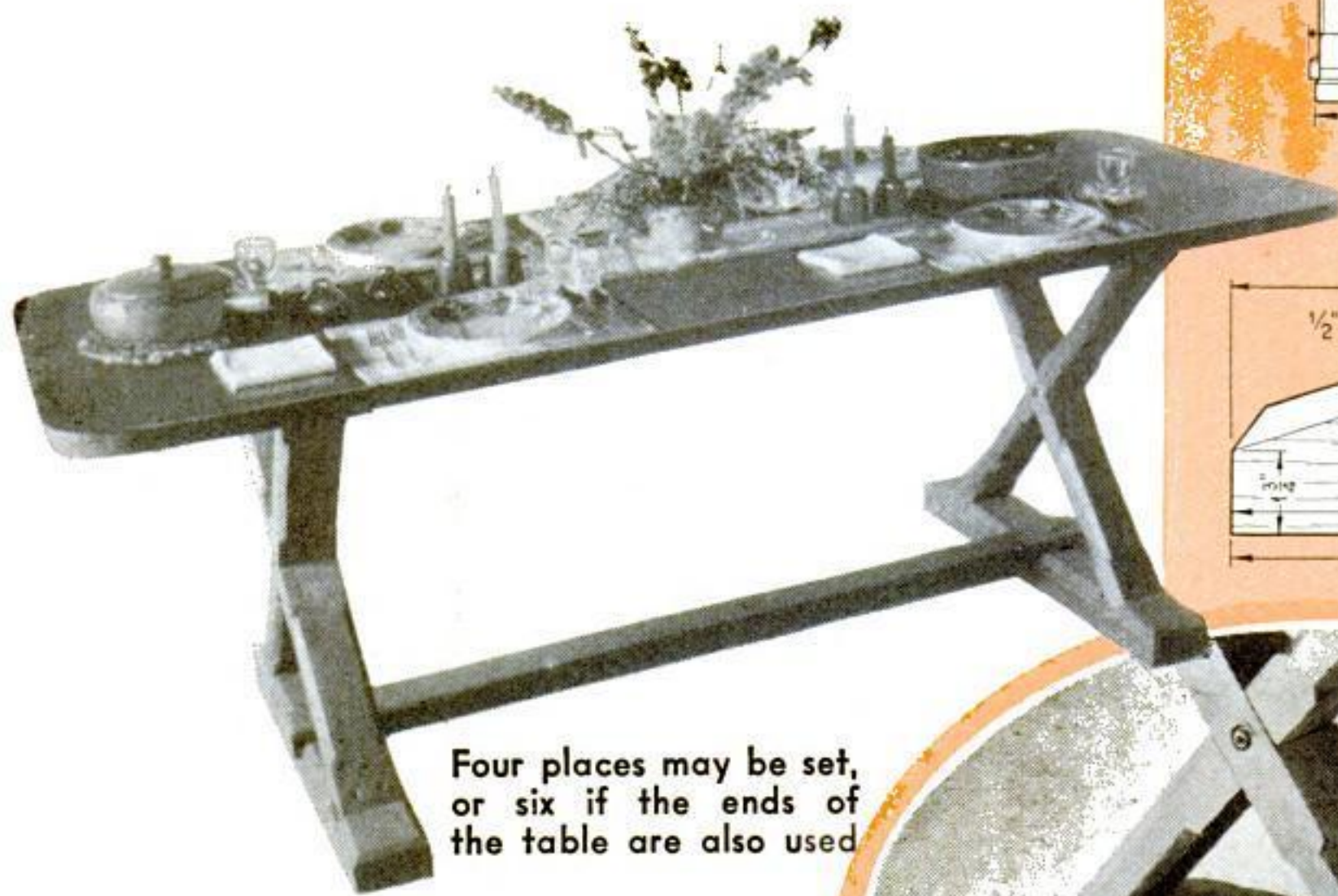


Mast

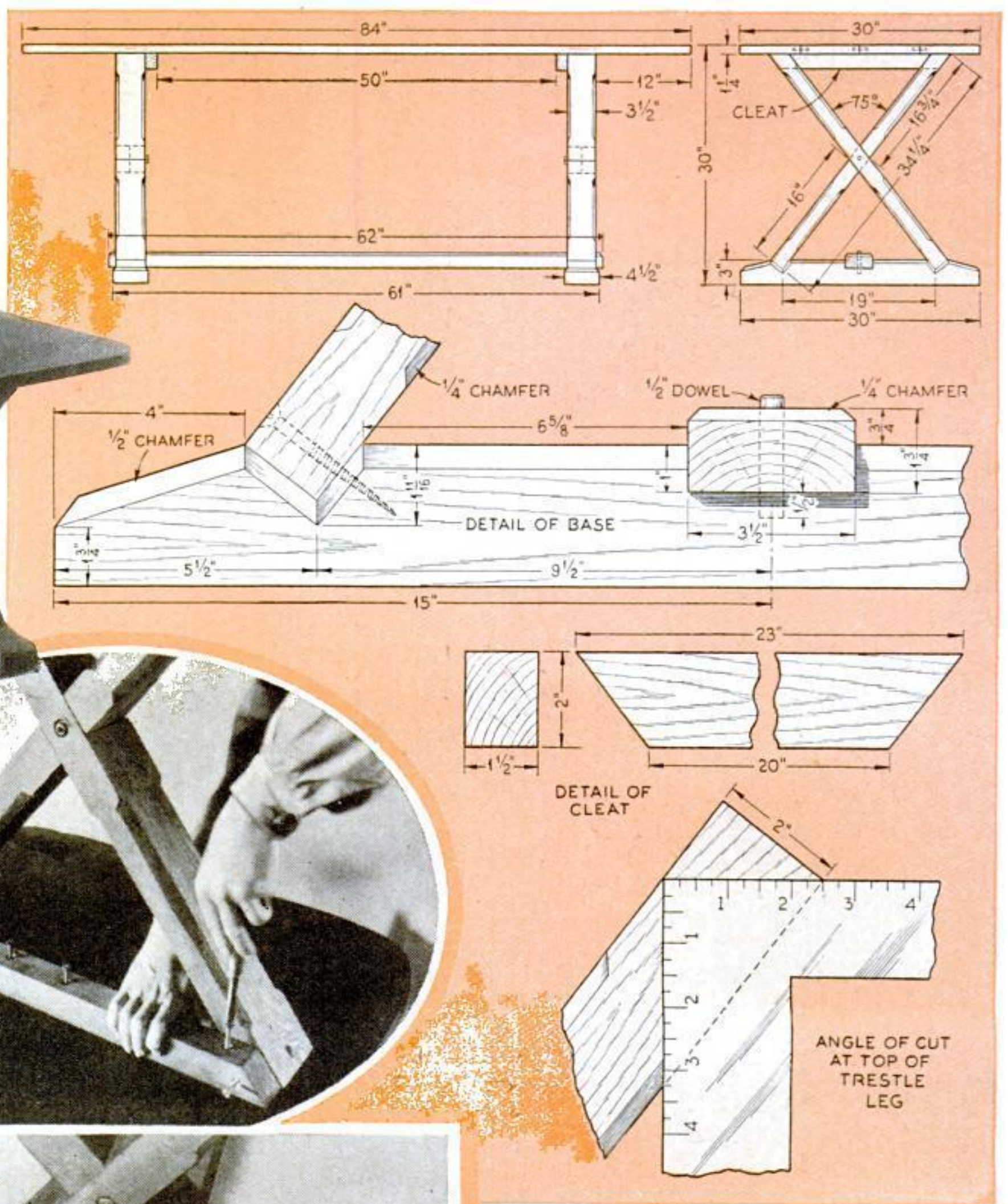
Sprit

The oars and other items above and the spars at left are also half size

Trestle Table for Modern Use



Four places may be set, or six if the ends of the table are also used



IN HANDMADE furniture, the lines should be natural and frank, clean and secure, dignified and convincing. All these requirements are clearly exemplified in this modern adaptation of the ancient trestle table. It provides for the informal living room or combination living and dining room a suitable board for meals.

Note especially the low stretcher, close to the floor, which allows clear space under the table for the knees. The trestles are also set back far enough at either end so that a person may sit comfortably at the ends of the table. The crossed trestle legs are formed opposite to the conventional method, giving a broader and more effective support to the top, and the sturdy base adds strength and interest to the design.

Outside of the table top, which is formed from four pieces of 1 1/4-in. stock, there are only nine pieces to be worked and fitted together with easily constructed joints. The list of materials is given at the end of this article. Either hard or soft wood may be used. The table illustrated was made of Douglas

fir, stained a dark oak color, and waxed.

If you have clamps large enough, by all means glue up the top yourself, using 3/8-in. dowels 1 ft. apart to reinforce the three joints. If you do not have the necessary tools for this work, have the material glued up at a mill or cabinet shop.

Above, the drawings. Left, how the legs and stretcher join the base. In oval, fastening a cleat to the top

Next, mark off the position of the angular cuts and the notched joints on the 3 by 4 1/2-in. base pieces. Saw out the waste wood, and finish the notched joints by working down to the gauge line with the chisel. Bore 1/2-in. holes 1/2 in. deep in the center of the notched joints to receive the dowels passing through the ends of the stretcher. Bevel off all the upper edges of these two base pieces with a plane and draw-knife, and sand down smoothly. The stretcher is quickly made by beveling off the upper [\(Continued on page 125\)](#)

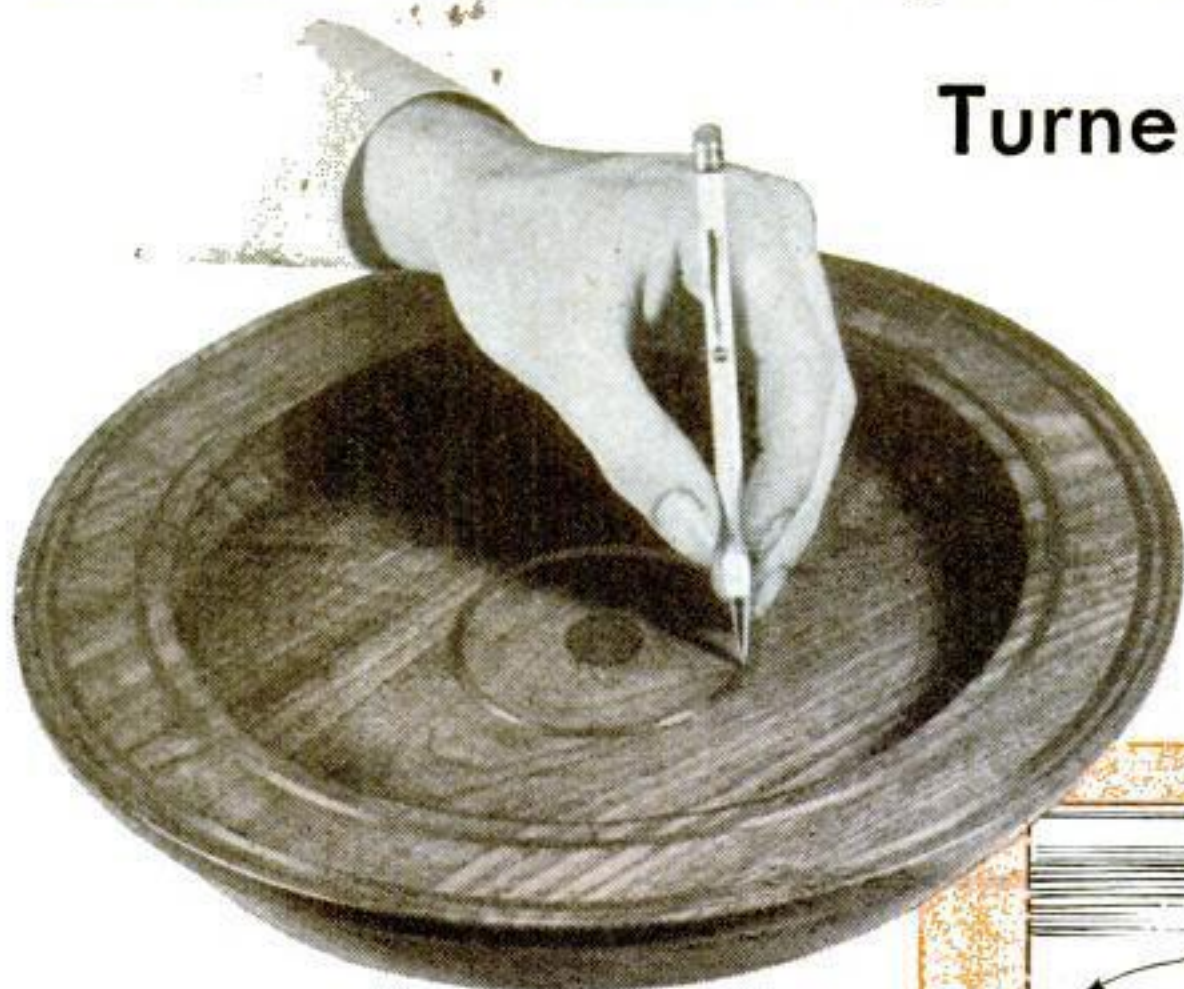
Turned Wooden Bowl Inlaid with Molten Lead

WOOD is inlaid with metal in various familiar types of decoration, but the Le Roy (N. Y.) Homeworkshop Club has developed a new and unusually simple process for doing the work. The lead-inlaid walnut bowl illustrated, which was made by this method, won a

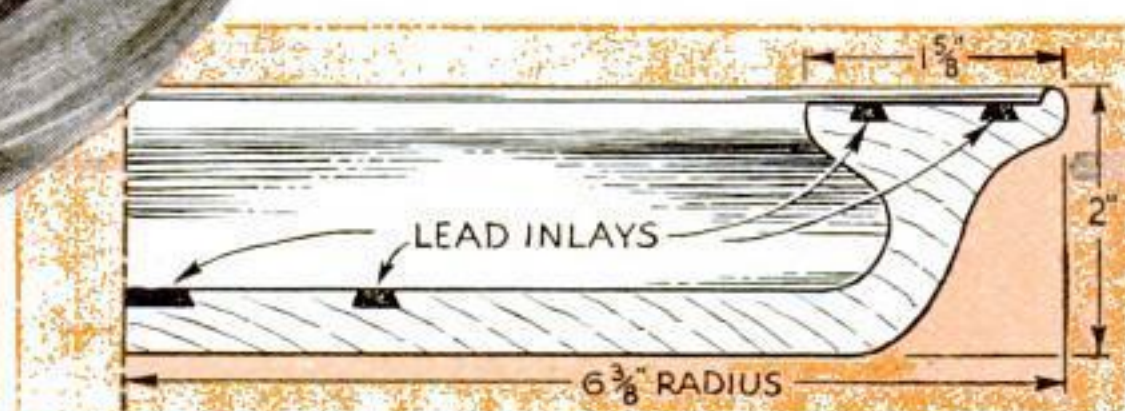
prize for the club in a three-hour project contest conducted by the National Homeworkshop Guild (see P.S.M., July '37, p.82).

The bowl was first turned in the conventional way. Slightly undercut or dovetail-shaped grooves were next cut about 1/8 in. deep to hold the decorative bands of lead, and a small circular recess was also turned in the center. After the bowl had been removed and laid flat, molten lead was carefully poured into the grooves and the central recess. Then the bowl was replaced in the lathe so the lead could be trued up and the work finished.

Many other similar projects may be made in the same way.

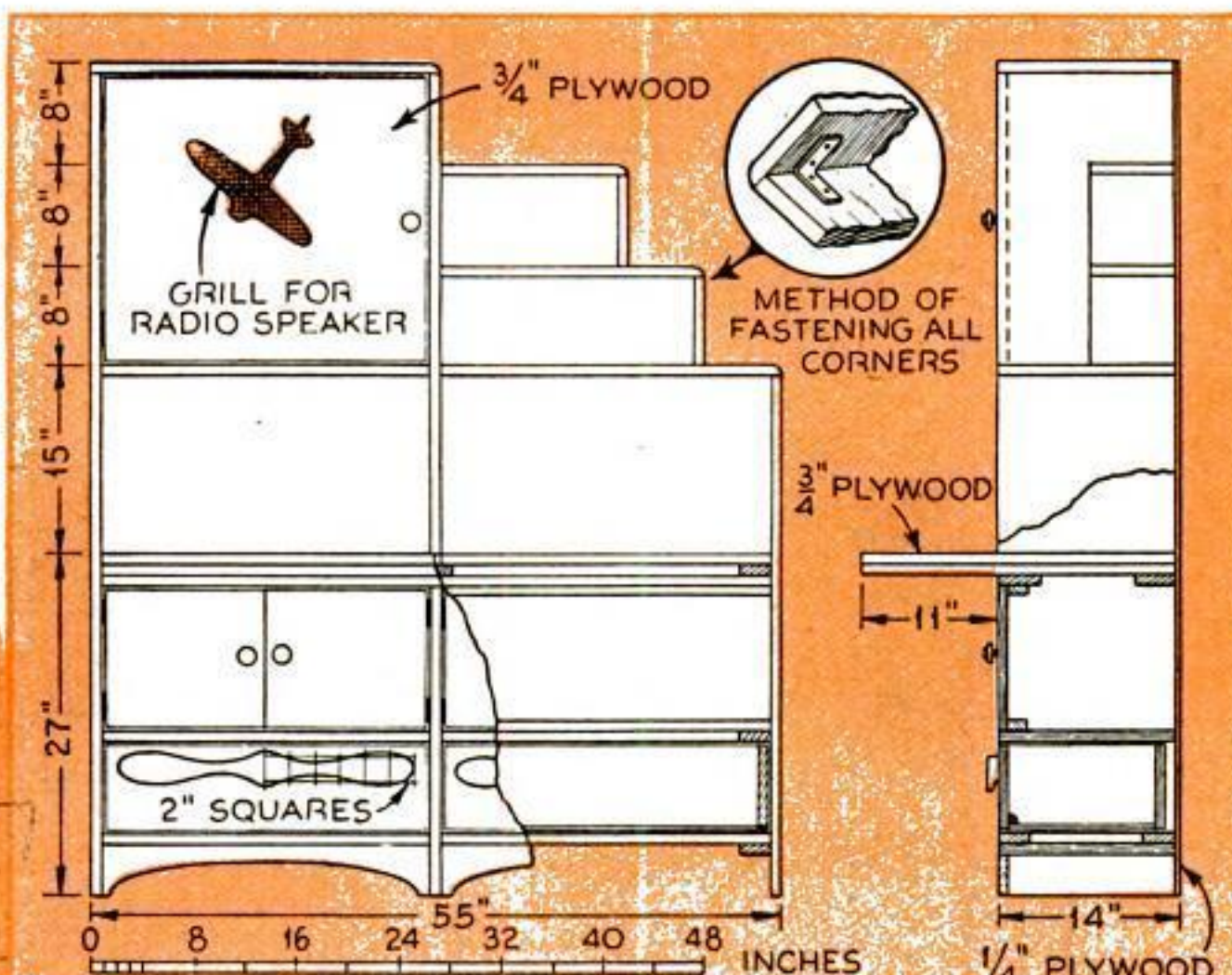
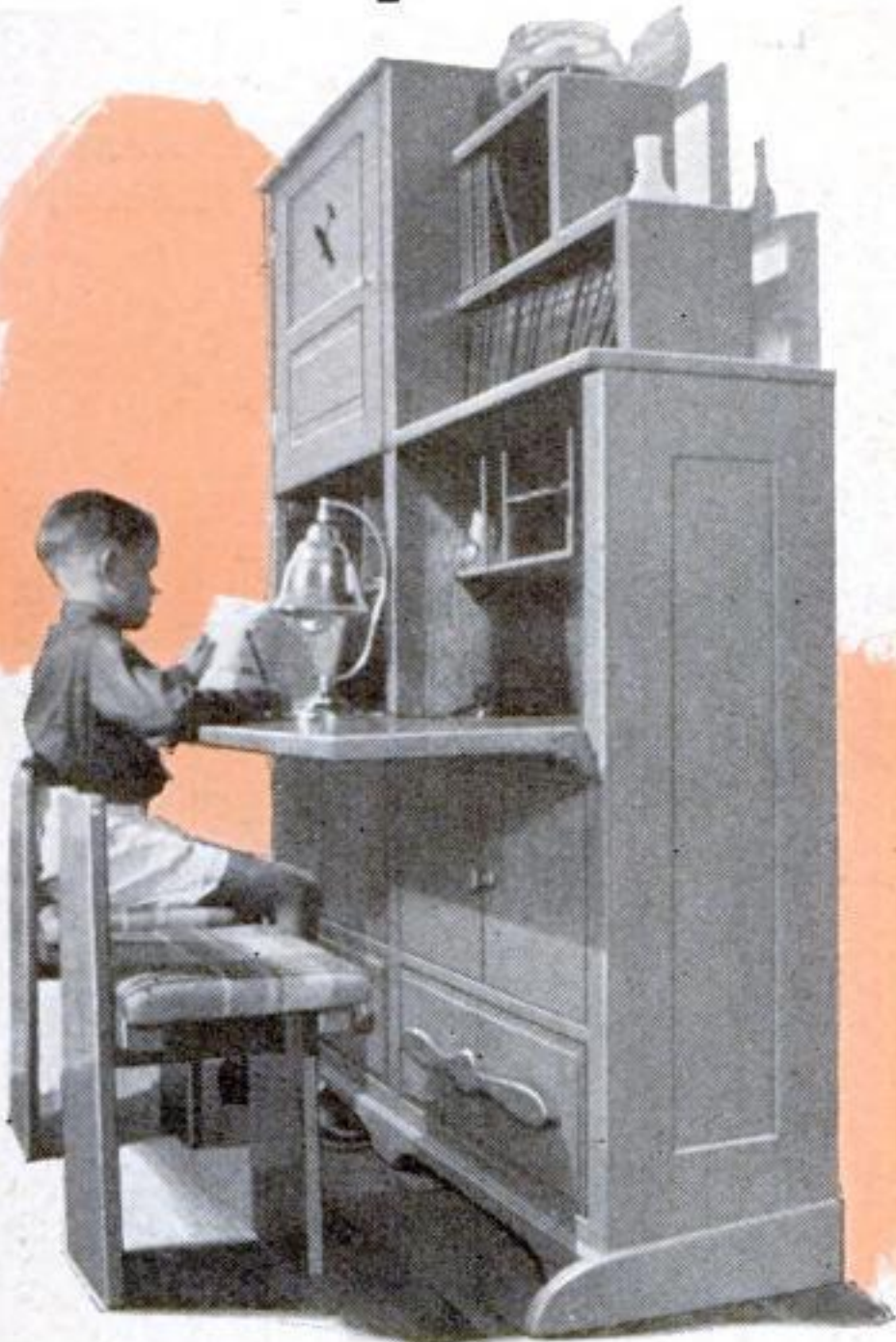


The decorative bands and central inlay are of lead, cast in grooves

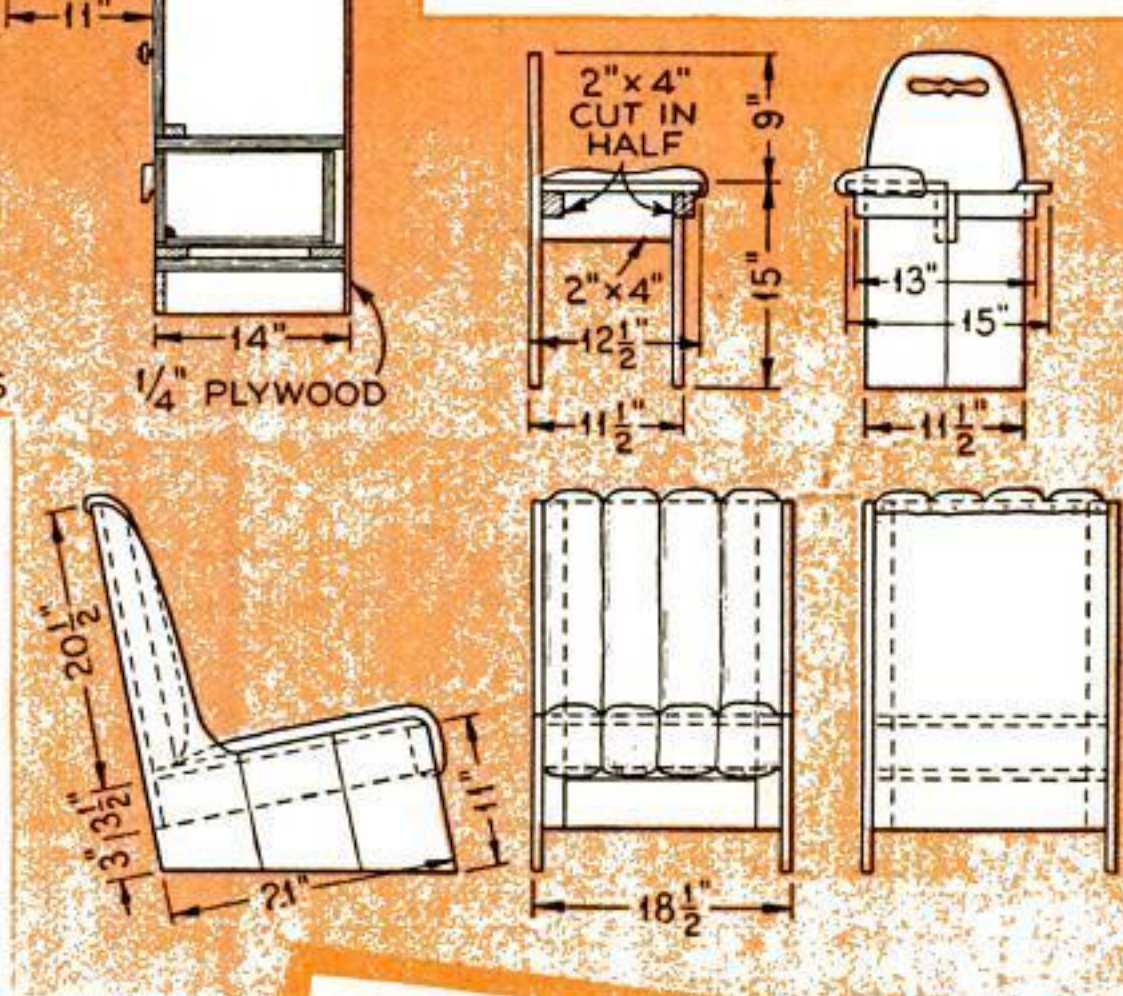


Airplane Furniture

GIVES NOVEL EFFECT
IN A ROOM FOR BOYS



Home work isn't nearly as much of a task if boys have a desk of their own like this. Chairs are made to match in the two styles shown



FOR an amateur woodworker who has only a few hand tools to construct boys' room furniture of airplane design, including a double-deck bed, chairs, and a large desk, may seem impossible, but it can be done. A saw, hammer, plane, screw driver, brace and bits, and coping saw are sufficient.

Standard dimension lumber is used throughout. Knotty pine finishes up well, but I preferred to enamel the wood. Blue, with airplane propellers and knobs painted orange, is pleasing, and, if you wish an enamel finish of this type, get good smooth pine. Be sure it is dry and straight.

Build the bed first, starting with the head, which is made of four pieces of 1 by 8-in. shiplap and one piece 1 by 12

in. Note in the drawings below how the shiplap is placed to make a strong corner.

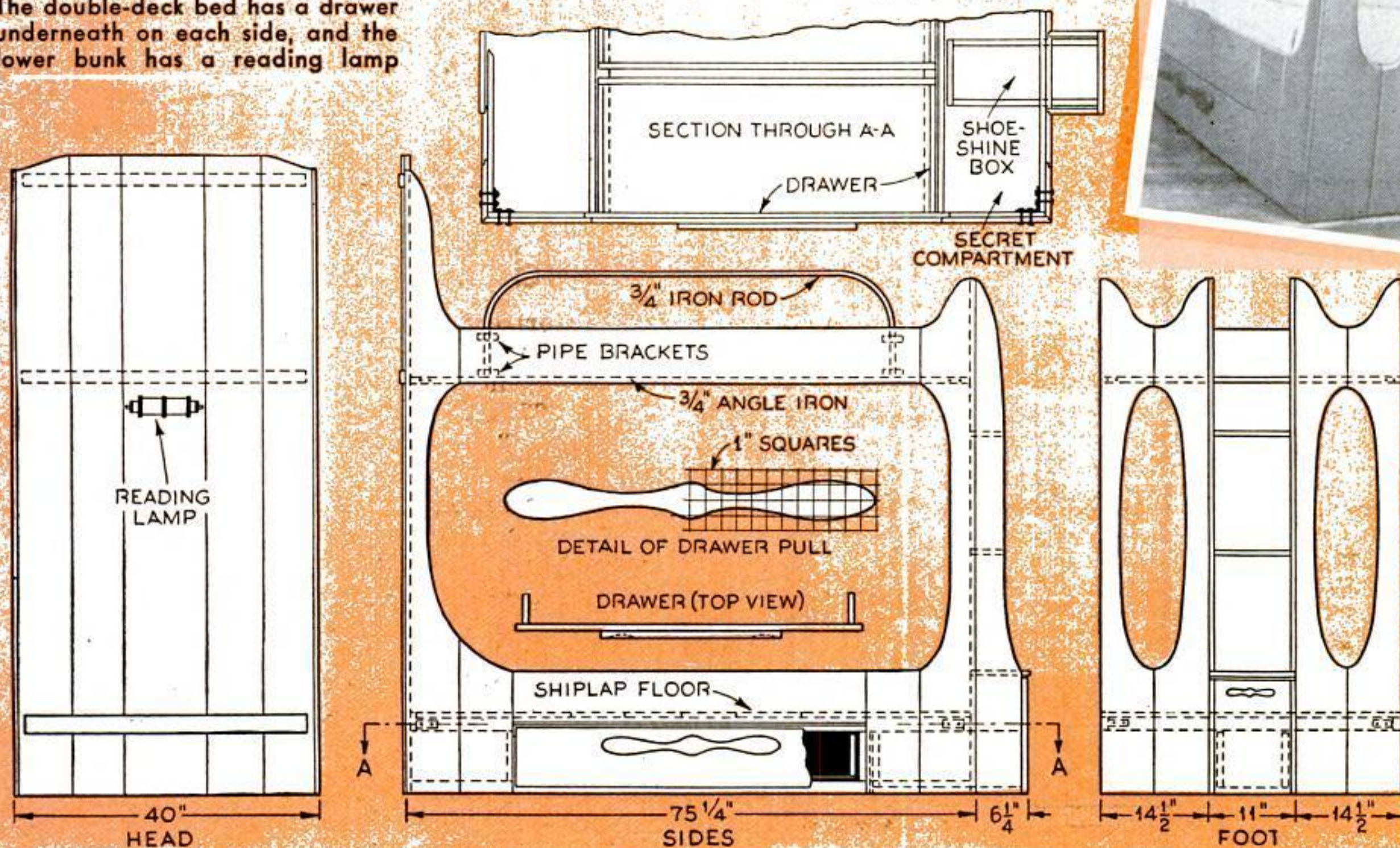
When you have completed the head and bolted the corner braces, place it against the wall of your workshop and nail it lightly to the wall with long finishing nails, being careful to get in square.

Next work up the corner uprights, which should be finished on the bench. Bolt them in place with a corner brace and a 1 by 2-in. strip on the lower bed, and a 3/4- or 1-in. angle iron on the upper. Be sure the uprights are cut to proper length—exactly 74 in.

The remainder of the work is easy if you follow the plan closely. Shiplap laid crosswise is (Continued on page 125)

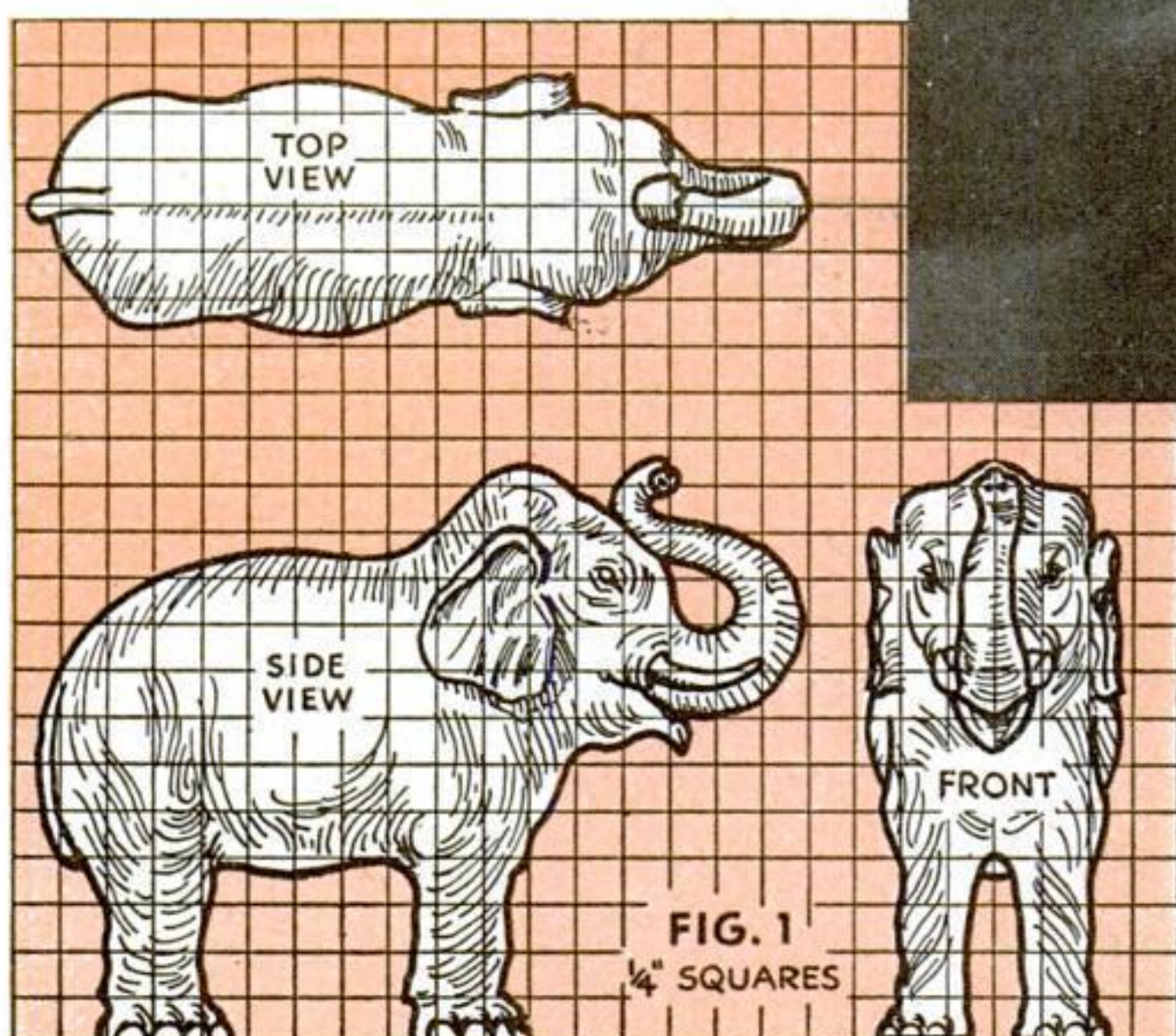
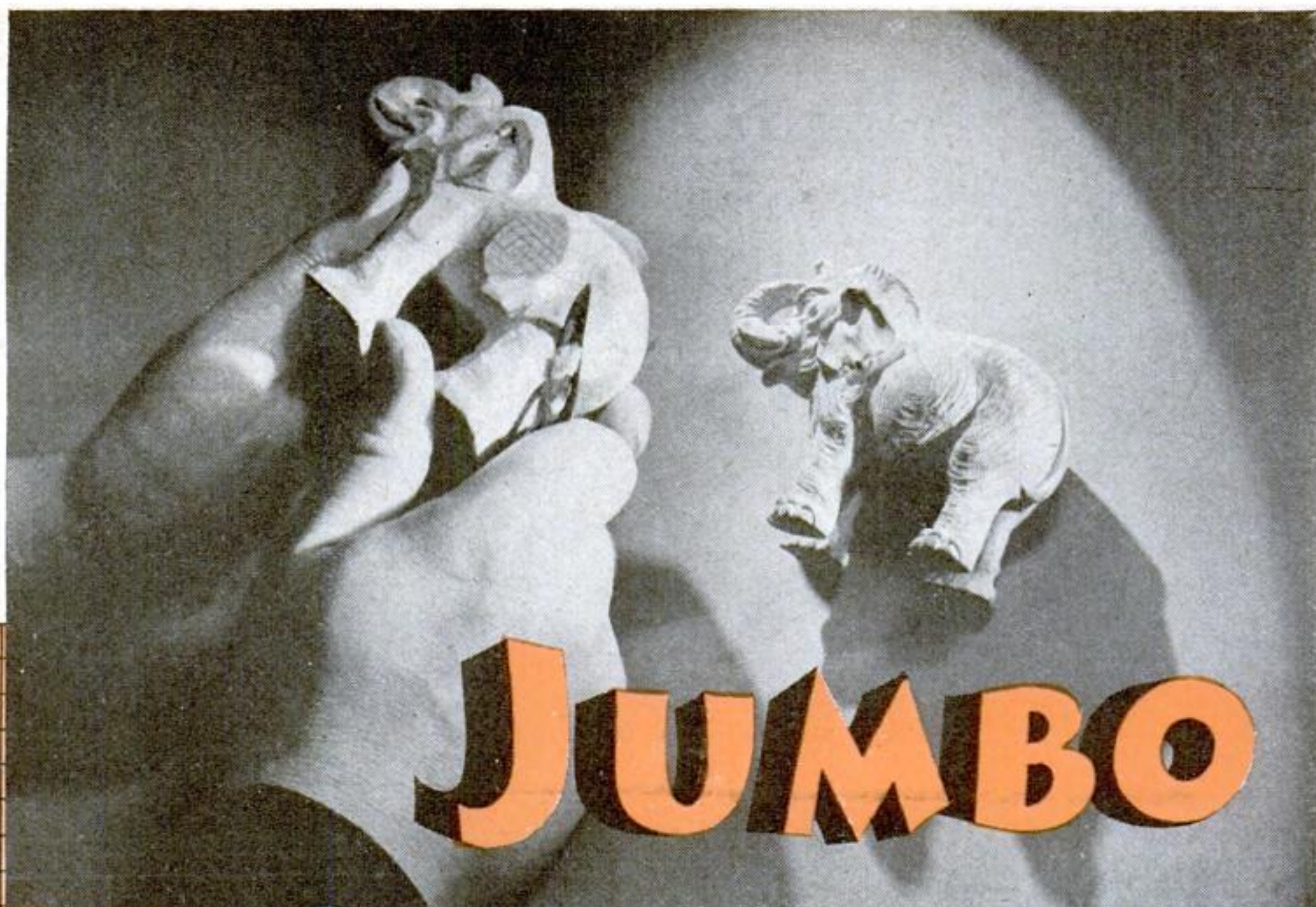


The double-deck bed has a drawer underneath on each side, and the lower bunk has a reading lamp



A ladder is provided at the foot of the bed, and iron guard rails at each side of the upper bunk. The bed comes apart, if necessary, for moving

You get an actual model to copy with our new elephant whittling kit



In each kit is an elephant like that at right above, and a pine block sawed and marked as in Fig. 2 below

FIG. 4
Detail of Ear

FIG. 5
Detail of Eye

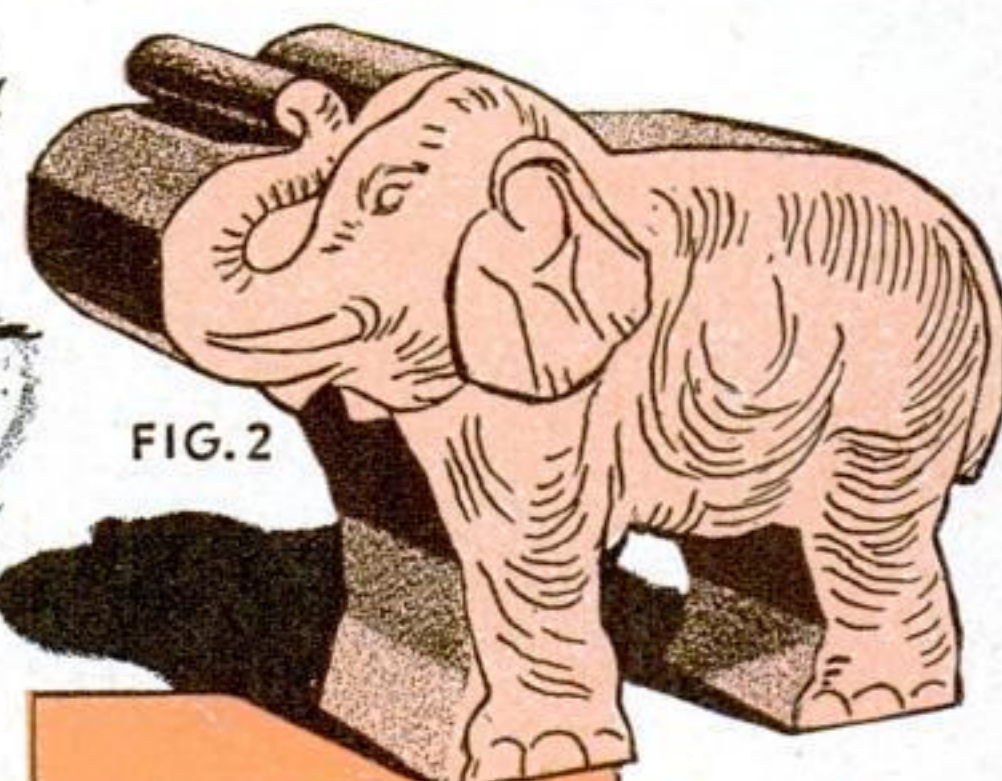


FIG. 2

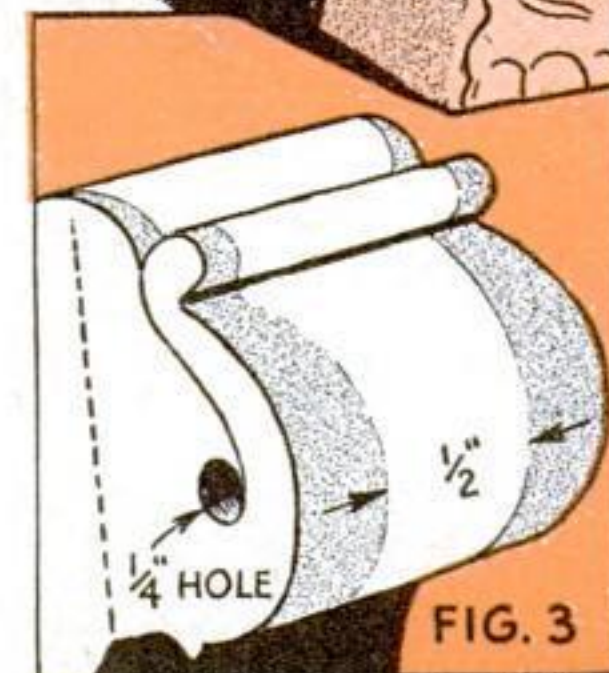


FIG. 3

The marked and sawed-out block, and various details to guide in whittling it

TO HELP you learn to whittle like an expert, we are offering another remarkable new kit containing not only the necessary materials, but also an actual model of the finished article—in this case, Jumbo the elephant. You can set the model before you and copy it until you have duplicated every knife cut perfectly. It is much easier to do this than to work from drawings alone, and the results are bound to be more satisfactory. The complete kit costs only \$1.50, postpaid.

Including a model in a whittling kit is an exclusive POPULAR SCIENCE MONTHLY service (see P.S.M., Jan. '37, p. 71, and also p. 23 of this issue). Naturally, if E. J. Tangerman, our whittling expert, should sit down and carve one model individually for you to copy, the cost would be prohibitive. The models are therefore made from wood composition by a special process that duplicates

every tool mark of the original. They look and feel like wood and, when stained or painted, cannot readily be distinguished from the hand-carved master model. After copying the model, therefore, you can convert it into a gift or utilize it in any way desired.

There is a white-pine block in the kit $1\frac{3}{8}$ by $3\frac{1}{8}$ by $4\frac{1}{8}$ in., with the grain running the long way. It has been sawed out and marked as in Fig. 2, so you are saved that work. A $\frac{1}{4}$ -in. hole must be drilled as in Fig. 3, and two wedges cut from the head as indicated by the shaded portions of Fig. 3.

Outline the ears with the knife point, then cut away the wood all around (see Fig. 4). Do the same with the

(Continued on page 132)

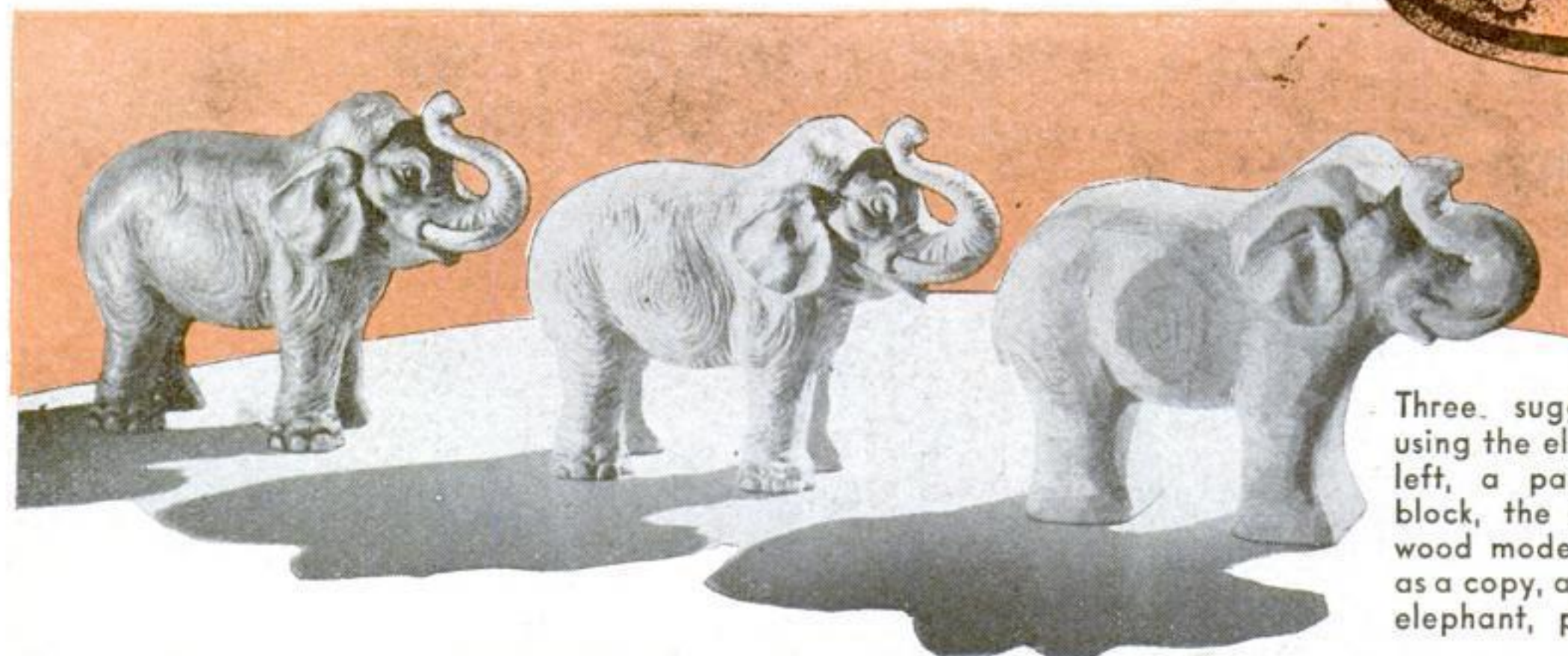


Paper Weight



Book End

Ash Tray



Three suggestions for using the elephants and, left, a partly whittled block, the composition-wood model that serves as a copy, and a finished elephant, painted gray

Monthly
Bulletins

Survey
Reports

Program
Outlines

Job
Sheets

Working plans, lists
of free movies, book-
lets, and catalogues,
and other invaluable
reports are mailed
to every Guild club



Official Magazine
POPULAR SCIENCE
MONTHLY

START A HOME WORKSHOP CLUB AND PROFIT BY THE GUILD'S FREE SERVICES

BY ISSUING monthly bulletins, distributing job sheets for metal and woodworking projects, and conducting surveys of available program material, the National Homeworkshop Guild is able to assist its affiliated clubs in many ways. These services are entirely free; in fact, there is no charge at present for joining the Guild, and no dues are collected.

You and your friends can participate in these benefits by organizing a home workshop club in your neighborhood. The Guild stands ready to help you and will send full information, including an application blank for a free charter, upon receipt of a large, self-addressed, stamped envelope.

Since its formation in the fall of 1933, the Guild has helped several hundred clubs throughout the United States and Canada. Unlike most other national organizations, the Guild requires no payment of any kind from its members. It has but one purpose: to further the home workshop hobby. If you have a workshop, even if it consists of nothing more than a kitchen table and a few hand tools, you owe it to yourself to start a club and join the Guild.

The Guild bulletins (mailed monthly to club secretaries) contain a wealth of material of interest to home workshop fans, including announcements of contests, book reviews, lists of manufacturers' booklets and moving pictures, club notes, and the like.

In the last year, plans for book ends, chairs, tables, lamps, models, and novelties have been sent with the bulletins, and similar projects will be included during the coming season.

A Program Service Bureau was established by the Guild last year to help the clubs plan more instructive and entertaining programs. Among its services have been the compilation of a list of one hundred 16-mm. moving pictures that can be borrowed free from various agencies and a list of home workshop experts willing to address clubs, a tabulation of cooperating manufacturers, and the preparation of program outlines on whittling, home repairs, how to make wood inlay pictures, safety in the workshop, and the like. Some of these reports are still available and will be sent free of charge, as long as the supply lasts, to each new club that is chartered by the Guild. A charter for the

club, suitable for framing, and annual affiliate cards for all the members are also supplied free.

Don't fail to take advantage of these opportunities. The Guild will recognize as a club any noncommercial group of five or more persons, sixteen years of age or over, who promise to meet at least once a month and promote the home workshop hobby.

National Homeworkshop Guild 347 Fourth Avenue, New York

Please RUSH full information telling how I can organize a home workshop club in my neighborhood, how I can obtain a meeting place and publicity, and how I can build the club into a successful organization. Be sure to include a model constitution and by-laws, and an application blank for a free charter in the National Homeworkshop Guild.

Inclosed is a large (legal size), self-addressed, stamped envelope for your use in sending me this material.

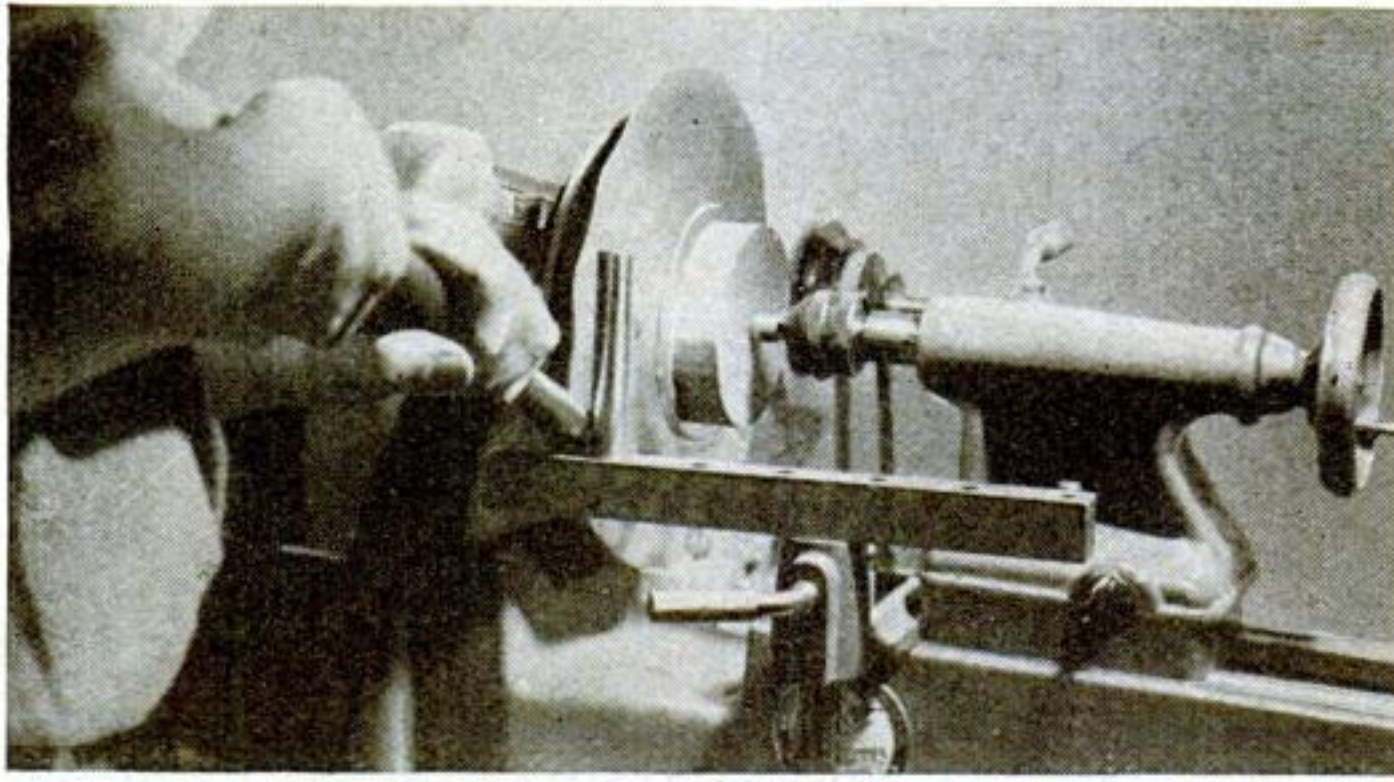
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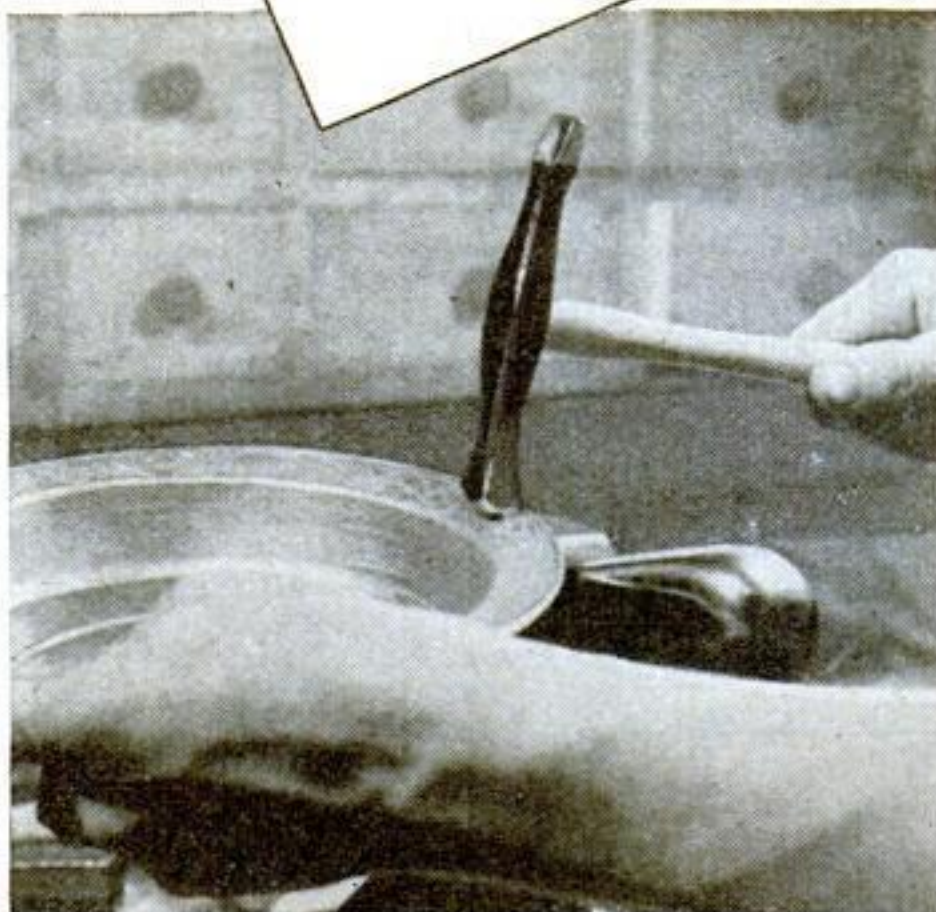
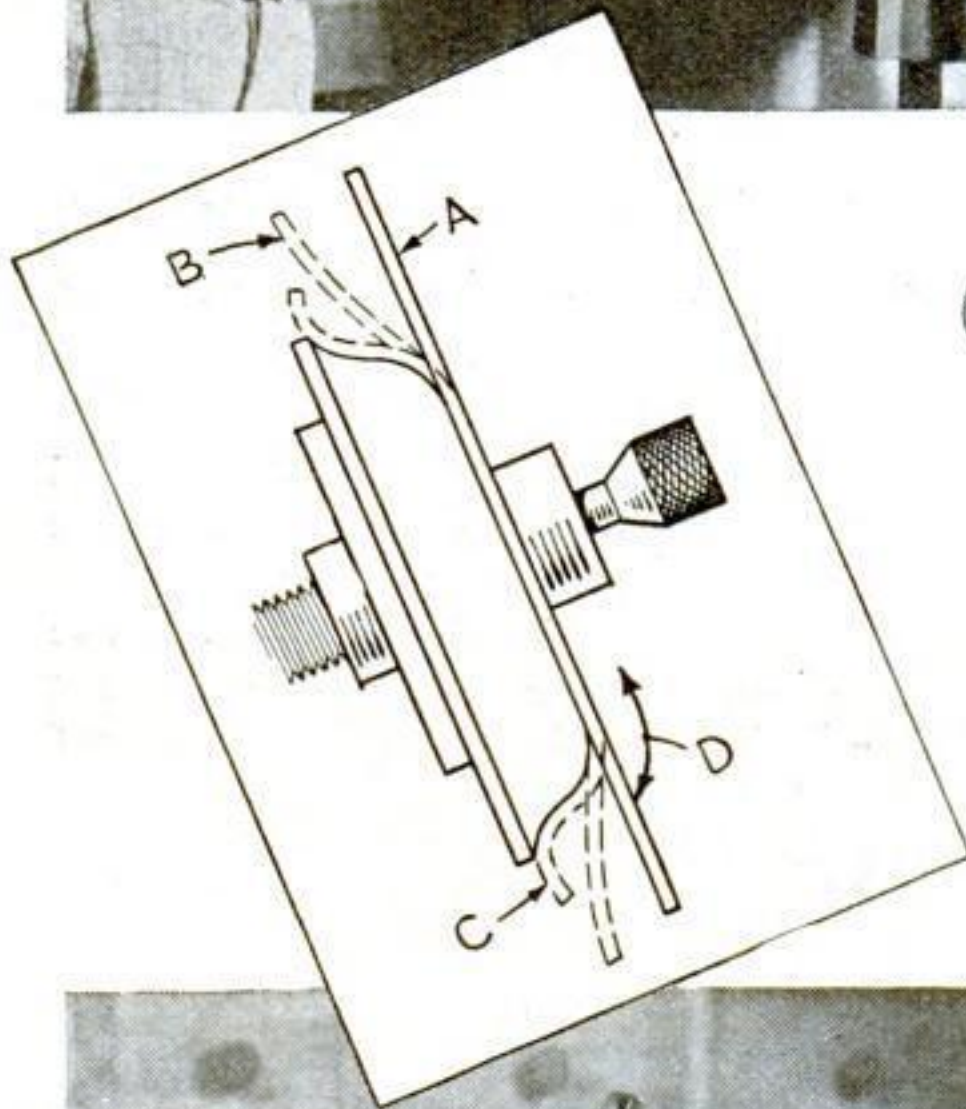
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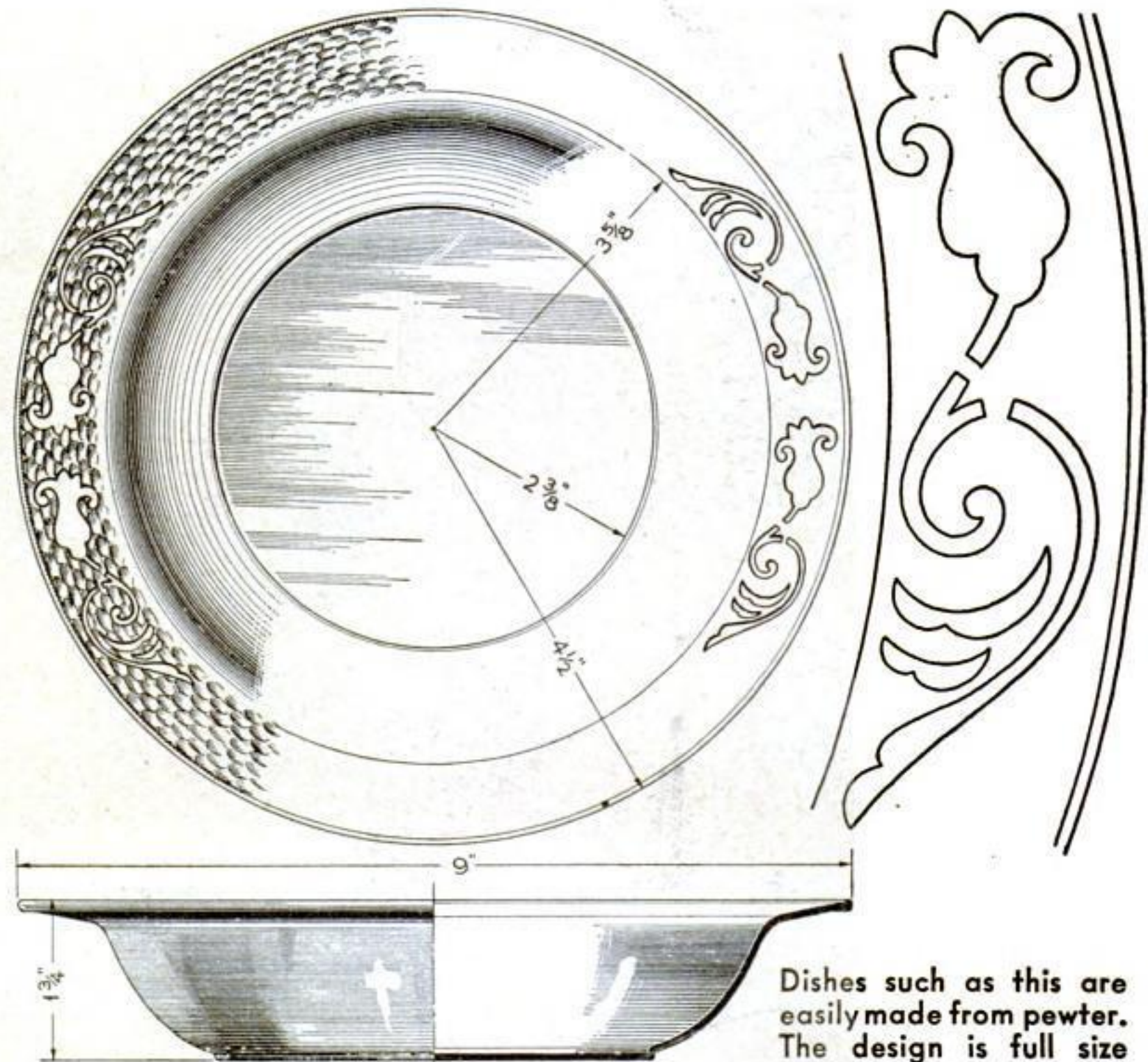
SPUN-PEWTER



Fastened between the chuck and tail block, the metal disk is shaped with the round-nose tool. Below, turning a beaded rim



Spotting rim with rounded face of hammer. Above, stages in forming disk in the lathe



Dishes such as this are easily made from pewter. The design is full size

By FRANKLIN H. GOTTSHALL



Forming the rim with a raising hammer. The shell has to be kept perfectly round

MODERN pewter closely approaches silver in beauty, although it also possesses a distinctive quality of its own. With a lathe equipped for metal spinning and a few metal-working tools, the amateur craftsman has the means of making a number of beautiful and useful objects that also have a good market value. Pewter is particularly well adapted for spinning, because it remains soft. Most other metals, such as copper or brass, harden during the spinning process and must frequently be removed to be annealed.

To spin the cookie dish illustrated,

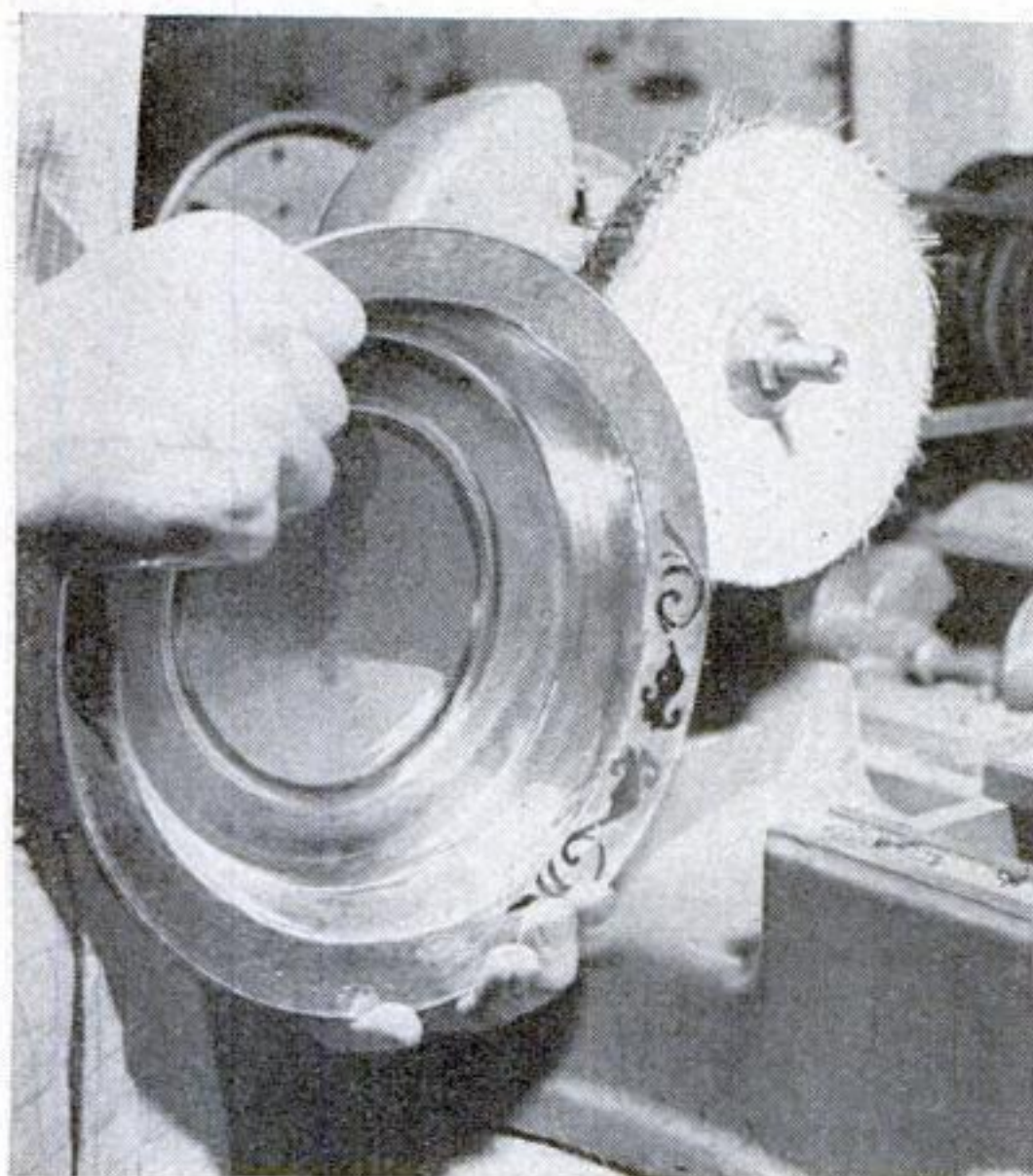
first turn the chuck from a hardwood like maple to withstand the tremendous pressure brought to bear on it while spinning. Fasten the 12-in. metal disk (16-gauge pewter) between the chuck and the tail block as at A in the drawings. Center the disk as carefully as possible and make sure it is perfectly flat. The edge is then trued up with the diamond-point tool, held in contact with the edge of the disk above its center. The tail block is held against the disk by means of the specially designed tail center used for spinning. This revolves on ball bearings. The entire mechanical set-up, including tool rest with loose-fitting fulcrum pin, is shown in one of the photographs.

The speed at which spinning is usually done may vary from 600 to 1,800 r.p.m. The cookie dish was spun at a speed of 1,020 r.p.m.

Lubricate the disk with floor wax or some other suitable lubricant, such as white soap or melted tallow applied with a soft cloth. Place the spinning tool against the left side of the fulcrum pin, and with the handle of the tool held under the right arm, bear against the revolving metal disk, and form it to the shape shown at B in the small drawing. Use either the tongue tool or the round-nose tool, working it back and forth as shown at D to prevent excessive thinning of the metal, and with the point of contact below the center of the disk. If the edge of the metal begins to crimp, remove it from the lathe and remove the crimps with a fiber-head hammer or a smooth-faced wooden mallet.

Complete the spinning as at C and roll up a bead on the edge of the dish by holding the roller of the beading tool

COOKY DISH



Tripoli and rouge are used on the buffing wheel for polishing the plate. At right, the completed cooky dish adds a decorative note to any table



tightly against the edge of the revolving shell, thus strengthening it.

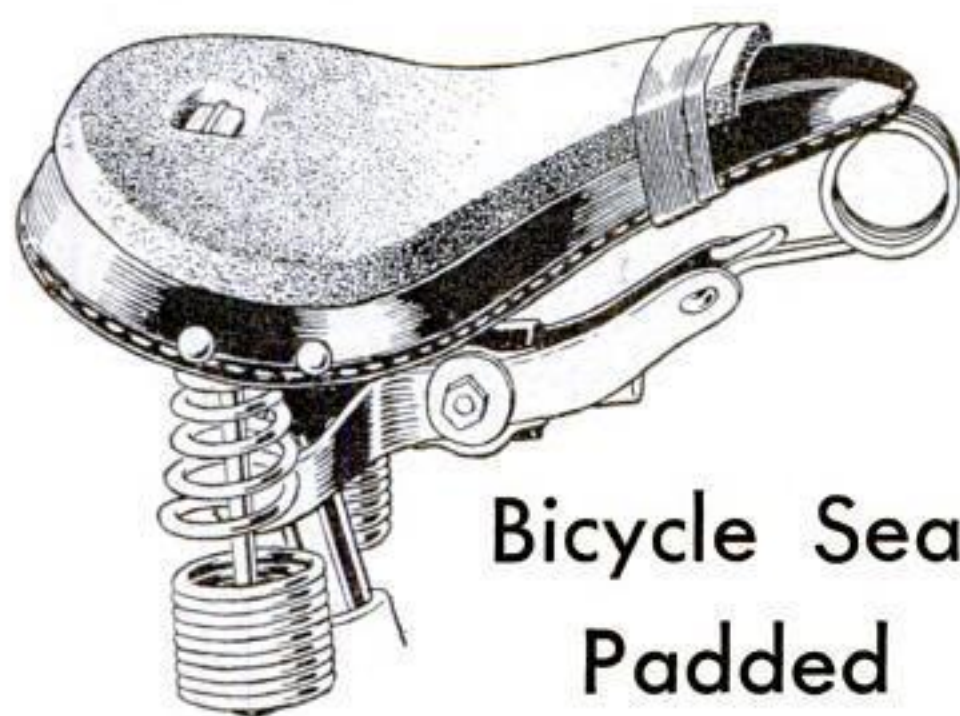
Remove the shell from the chuck, place it on the anvil, and form the rim. Do this very carefully so as to keep the dish perfectly round. Then spot the rim carefully with the rounded face of the raising hammer. If the inside of the dish just below the rim has become

marred or irregular, smooth it with the planishing hammer.

The rim design should first be traced on a scrap piece of pewter with the sharp point of a scratch awl and then drilled and cut out with a jeweler's saw and a No. 1 blade. True up the pattern with a fine needle file, if necessary, and use it to transfer the design to the rim

of the plate with the scratch awl. Avoid scratching the metal that is to remain. Saw out the design and, after truing it up with needle files, polish the dish on a buffing wheel with tripoli and rouge.

If you would like additional metal-work articles to be prepared, please send a post card to the Home Workshop Department.



Bicycle Seat Padded with Sponge Rubber

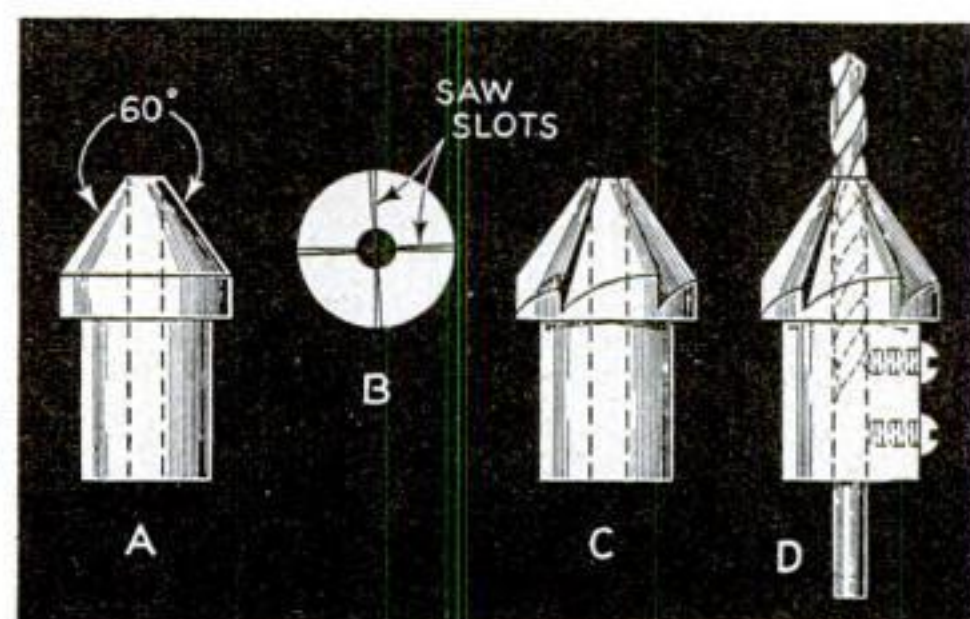
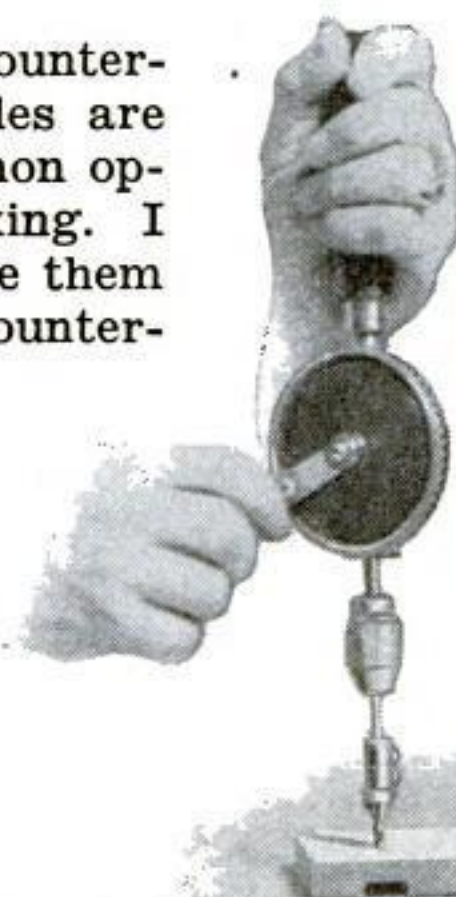
SPONGE rubber cut from a ten-cent kneeling pad can be used to make a bicycle saddle more comfortable. Trimmed to the same shape as the saddle, the sponge rubber is wired down securely on each side at the rear. An easy way to do this is to twist one end of a piece of wire around a bit of wood, then push the other end through the rubber and twist it around the spring under the rear part of the saddle. At the front, simply tape the rubber down from one side to the other. Make a cloth cover for the pad, with a draw string to tie to the saddle.—R. W. BRIGGS.

Rigging for Small Ship Models

FINE copper wire, obtained from an old radio loudspeaker or earphone, can be used for rigging on tiny ship models. A small drop of cellulose cement will hold it in place.—H. V. L.

Countersinks Fit on Ordinary Drills

DRILLING and counter-sinking screw holes are two of the most common operations in woodworking. I find it pays to combine them by making a set of countersinks that can be fastened to drills of the most-used sizes such as 1/4, 3/16, 7/64, 1/8, and 9/64 in. The countersinks are easily made if a metal- or wood-turning lathe is available.

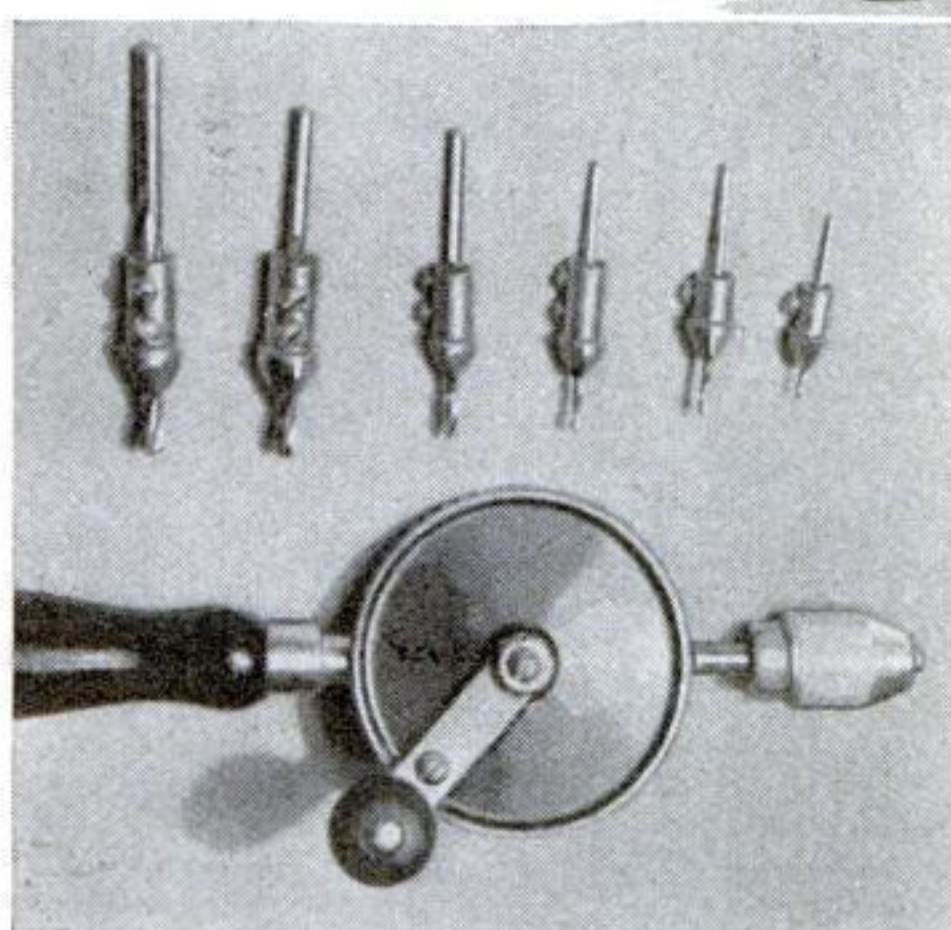


How the countersink is made to slip over a drill so both operations are done together

Use drill rod or a good grade of steel of the desired diameter. Chuck this in the lathe and drill a hole into the center 1 1/2 in. deep and of the diameter of the drill on which the countersink is to fit. Turn or file the stock to the shape shown at A, and cut the shaped part off.

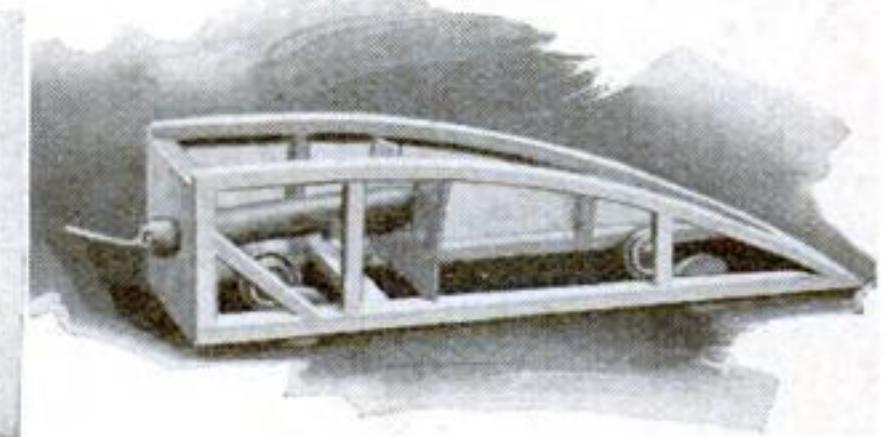
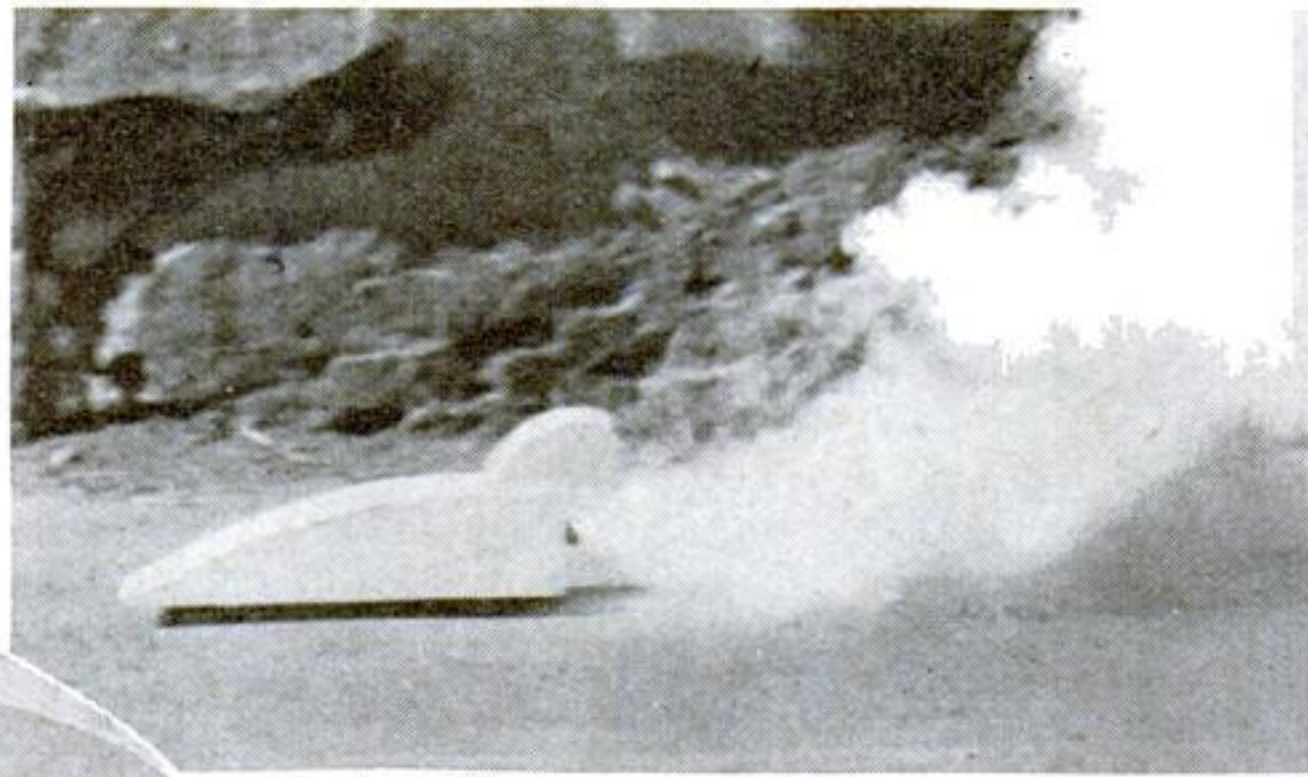
Saw four or more slots as at B, tapering from 1/16 in. deep at the point to 3/32 in. at the back. Then file the sections to the shape shown at C. The cutting edge can be protected by placing a hack-saw blade in the slot while the filing is being done. Finally, drill and tap for set screws as at D.

To insure durability, temper the tool by heating it to a bright cherry red and dropping it immediately into a pail of cold water.—PAUL G. LACKEY.



Made in several common sizes, the countersinks save much time in drilling screw holes

Rocket Propels Tiny Streamlined Car

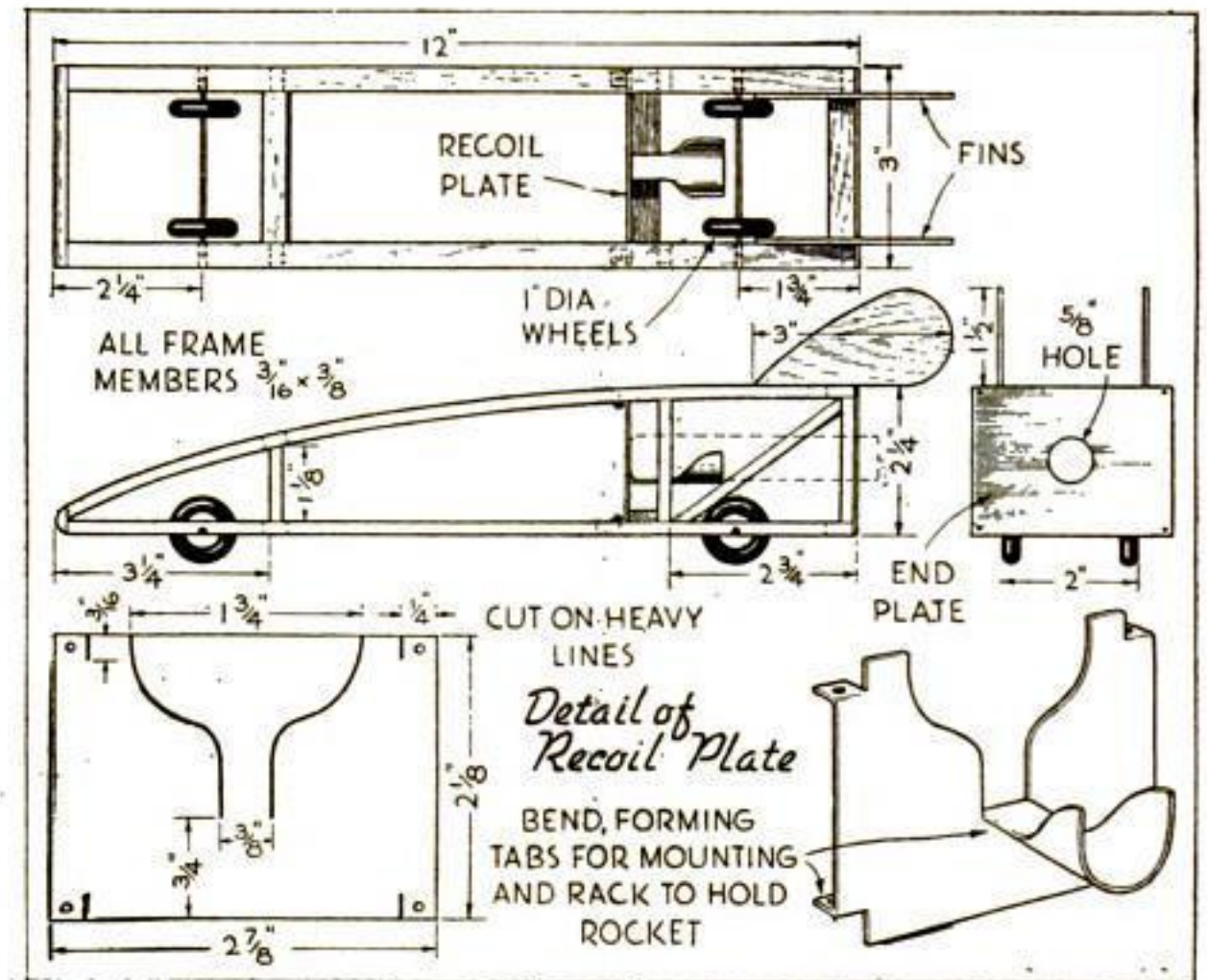


The rocket is held securely by the recoil plate, which should be tested before covering the model. At left is the car as it roars along, leaving a trail of smoke

ROARING along with its tail of smoke and flame, this miniature rocket car provides a novel toy, fascinating alike to young and old. If equipped with flanged wheels, it will race down the track like the experimental rocket cars of Europe. Balsa or any light wood is used for the frame members, which are

3/16 in. by 3/8 in. Cut the metal parts from thin aluminum or tin. Make the hole in the end plate 5/8 in. or whatever diameter is necessary for the small fireworks rocket which is used. Then bend the recoil plate to shape and install. Since it must hold the rocket securely in place, test the fit carefully. Make two stabilizing fins.

Cover the model with thin Bristol board, putting the sides on first; then the sloping top. Any type of toy wheels with a diameter of about 1 in. can be utilized. They may be left on the original axles or mounted on heavy wire and installed as shown.—ZUSSMAN FREEMAN.



Make certain all parts fit tightly. Cover the sides first

Garbage Can Swings into Neat Inclosure



The can swings out as the door is opened

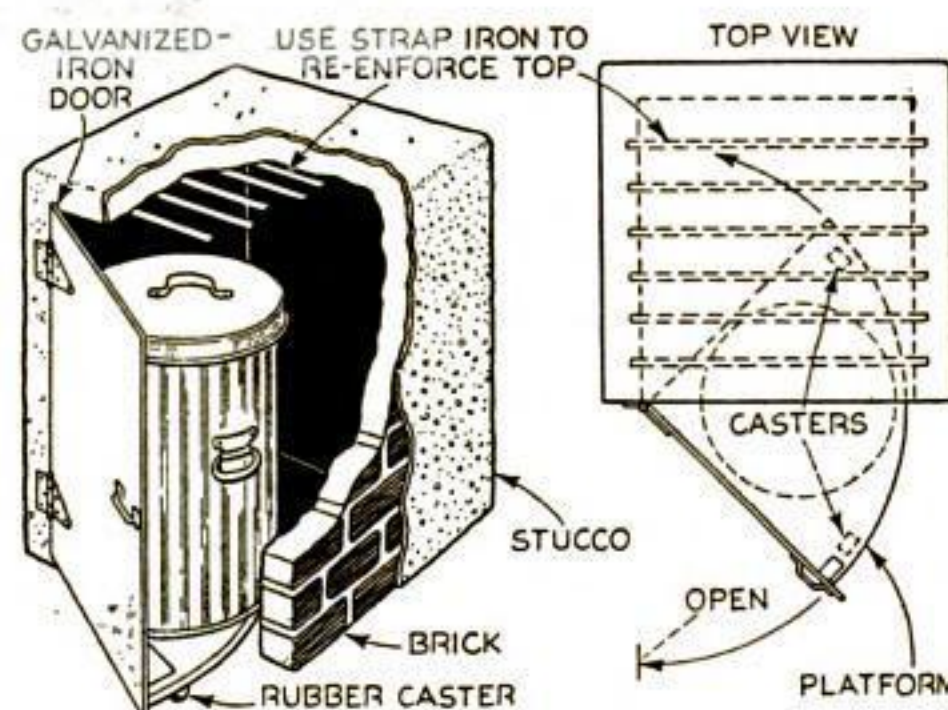
BY BUILDING an inclosure like that illustrated, it is possible to conceal the always unsightly garbage can. Prowling animals can no longer get at the can and scatter its contents, and obnoxious odors are prevented from escaping, a particular boon during warm months.

Discarded lime bricks were chosen for the small structure in this instance, and the exterior was plastered with stucco

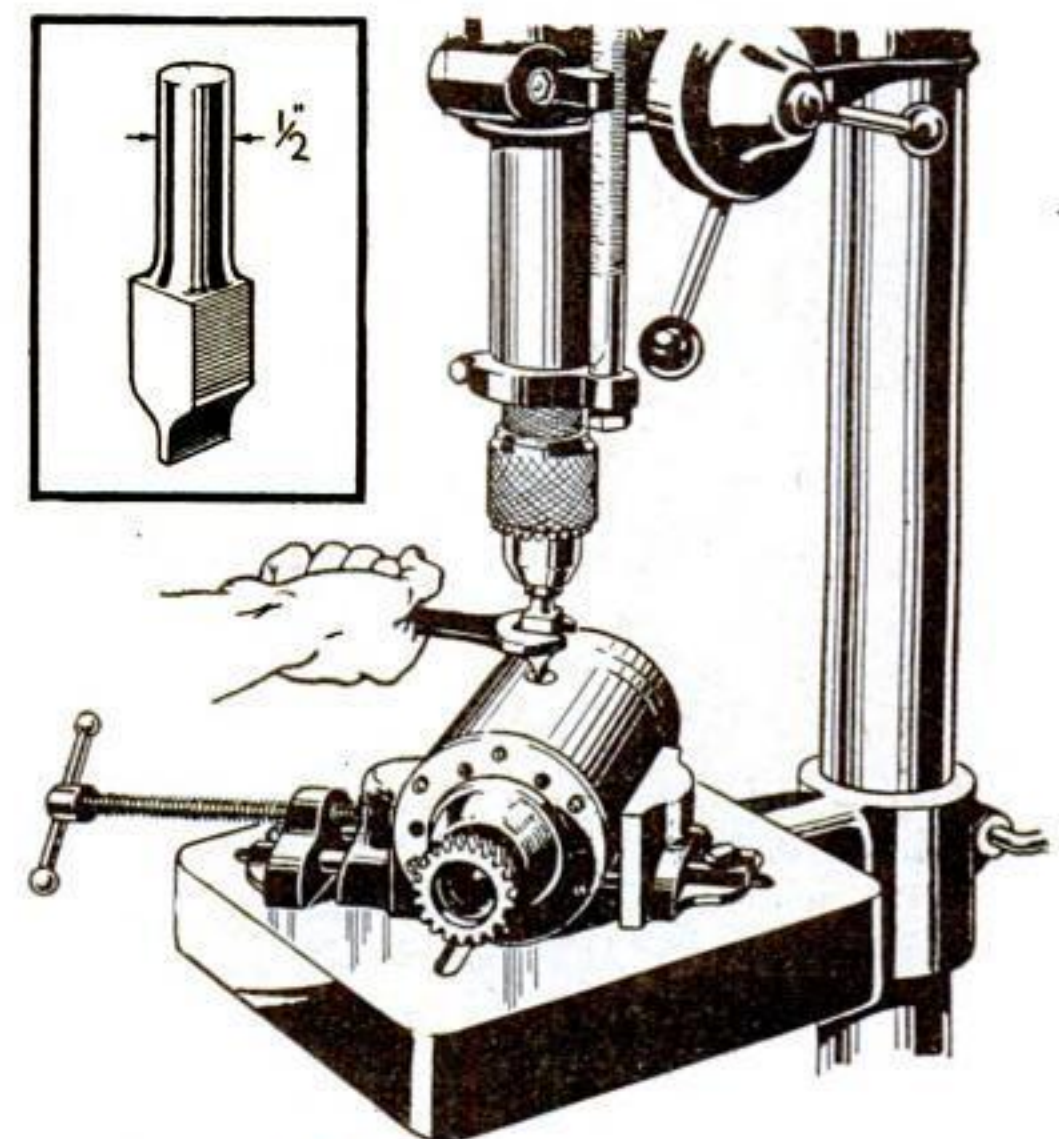


No prowling dog can open this receptacle

to harmonize with the dwelling. Brick, stone, or other materials may be used, depending upon the building that is to be matched. Heavy galvanized iron was used for the door and the platform or floor section on which the can rests, the latter being attached to the door and moving with it. Two casters of the noiseless type were attached underneath so that little effort is required to open and close the door. Even a child can easily operate it. Be sure to build the receptacle in a convenient place for the collector.—MATILDA E. DESORMEAUX.



How the inclosure and door are constructed



Powerful Tool Removes Stubborn Screws

SCREWS that are difficult or perhaps impossible to remove with an ordinary screw driver can be taken out easily with the aid of a tool made as shown and used in a drill press.

The machine or part from which the screw is to be removed is clamped in the drill-press vise or held on the table. The tool is inserted in the chuck, centered over the screw, lowered firmly into the slot, and turned with a spanner. As the screw is withdrawn, the tool is backed off.

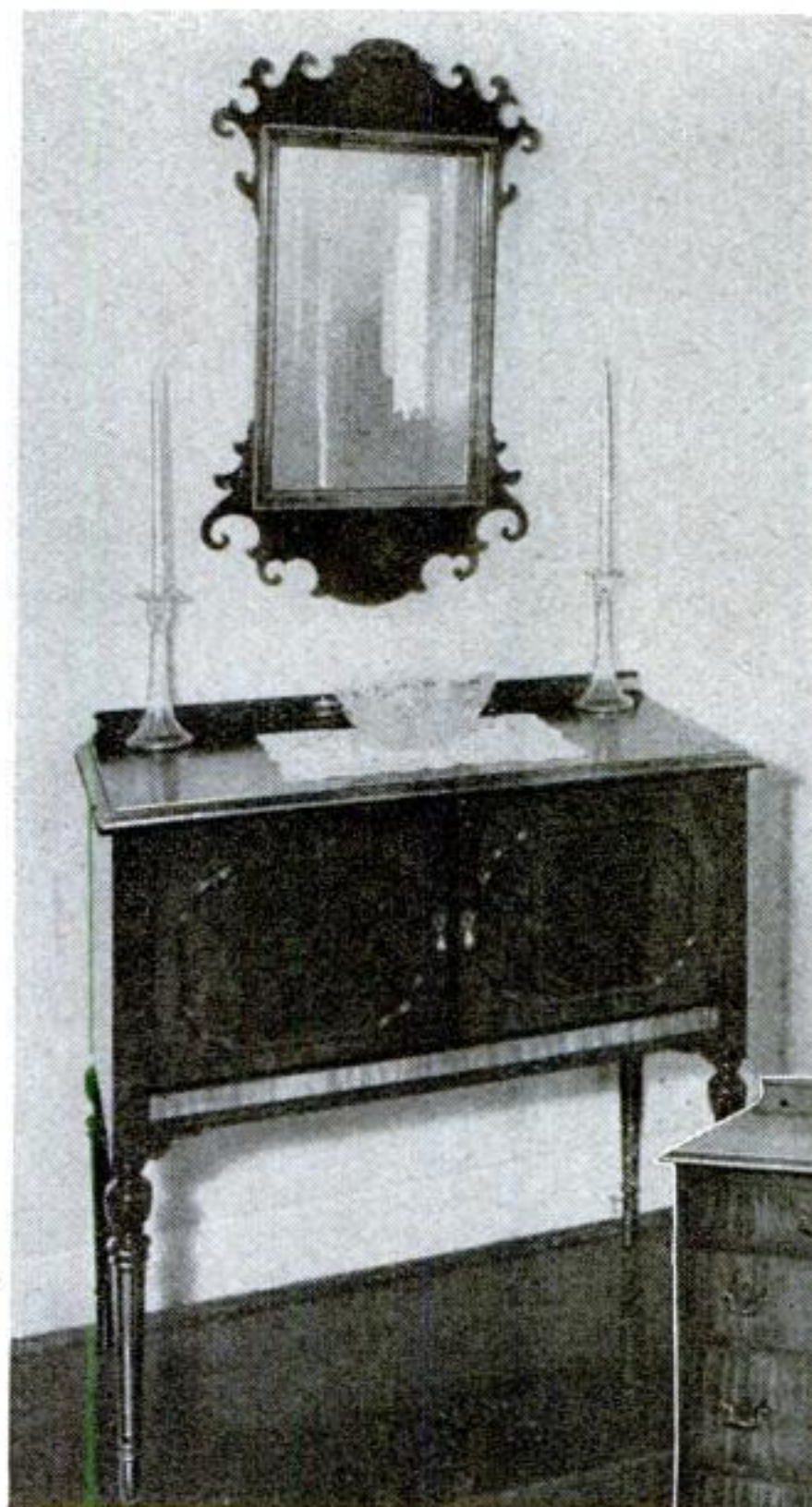
An old 3/4-in. drill with a 1/2-in. shank may be ground to form the special bit, which is square with a screw-driver point.—G. W. WHITE.

MIRROR FRAMES

Hints on designing and finishing them



Final inspection and clean-up of mirror. Wet cotton waste is used to remove any oil sludge



Chippendale mirror with wide effect for low room and, at right, a narrow effect for high ceiling

By
RALPH G.
WARING



MIRRORS reflect many things besides their beholders, and contribute much toward the proper accent in the furnishing of a room. Leave them out and the feeling of depth and space vanishes immediately. They therefore afford a fine outlet for the talent of the amateur craftsman, especially in respect to finishing the frames.

A reconstructed mirror frame, the original of which had been entirely wrecked, is shown on page 126. About all that could be saved were the rope-turned pilasters and the cross molding and cap. These were cleaned with denatured alcohol and steel wool, then sanded to the fresh wood. The upper and lower panel sections were next veneered with a center-matched piece of choice satinwood. The panels were dried one week and sanded with 4/0 paper.

The lower base and pedestal section had been lost, so these were made to scale and assembled as shown, leaving the two satinwood panels separate, to be screwed on the back after the finishing was completed.

This left only the upper glass panel to be considered. I never have liked the crude, garishly colored pictures that appeared to be typical of this type of mirror, so determined to work out something quite different. On a piece of thin, very clear glass from a large, old-style camera plate such as can be had from an old photographer's shop, I painted the design while the glass rested on the

drawing. To get the effect of considerable depth and permanently seal out dust, I glued a sheet of white mounting board to the back face of the frame. The space between this and the glass, about 1 in., gives a satisfactory shadow effect. The glass is, of course, set with the painted surface toward the back.

The specifications for finishing the mirror are as follows:

1. Complete all cabinet-work and secure pilasters, column, caps, panels, and pedestals with screws, which will permit separate finishing operations.
2. Disassemble, sponge with

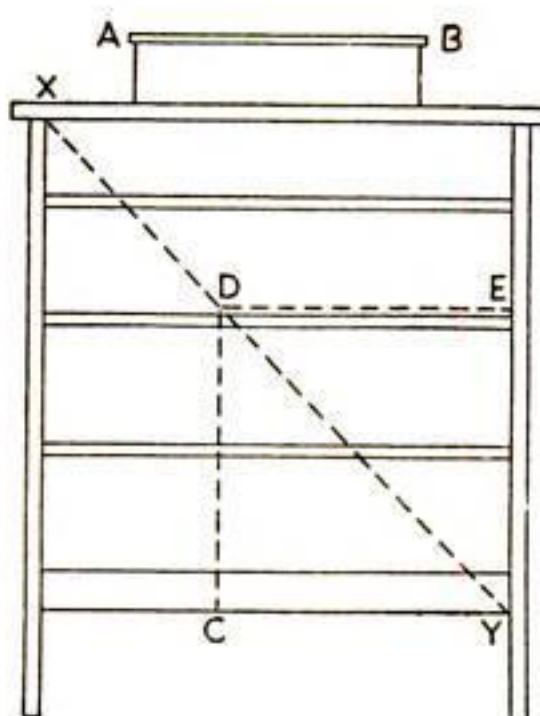


Diagram to determine height of mirror for early American high-boy shown at the right



clean water, dry, and sand with 6/0.

3. Stain walnut or mahogany as desired, using water stain. Dry twenty-four hours.

4. Stain satinwood panels and wipe immediately with clean cloth to prevent water from lifting the veneer. Keep satinwood golden in tone.

5. Seal all parts with one part white and one part orange shellac, reduced with five parts denatured alcohol. Dry hard.

6. Smooth very carefully with old 6/0 paper, moistened on back face.

7. Fill all walnut or mahogany with matched filler. Inspect and wipe clean. Dry forty-eight hours.

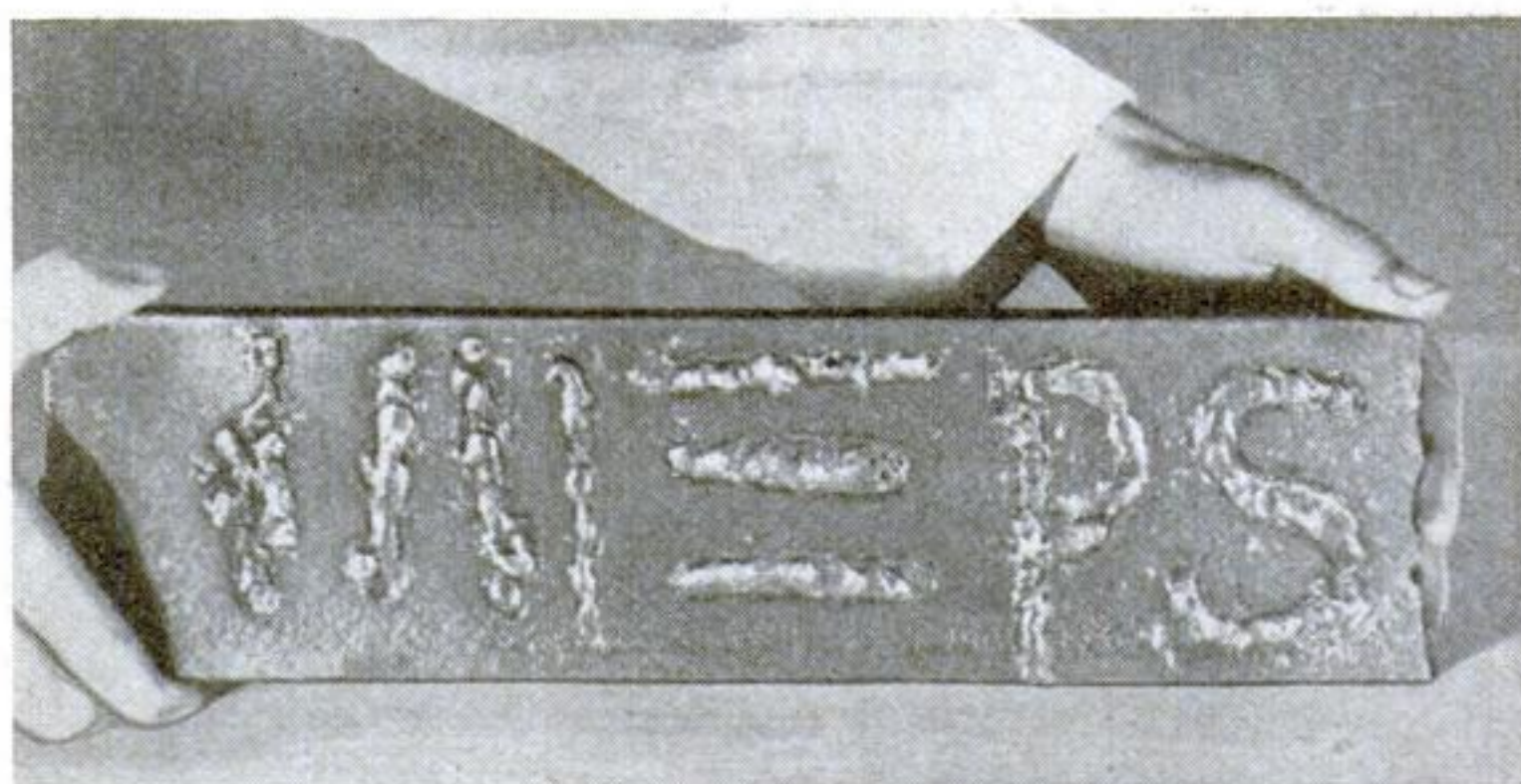
8. Varnish with full coat of four-hour floor varnish. Dry twenty-four hours. Sand with 6/0 paper.

9. Revarnish with from one to three coats as desired. Sand between coats with 6/0 paper.

10. Rub last coat with FFF pumice stone, crude oil, and felt pad or cotton waste.

(Continued on page 126)

HOW TO DO



First practice striking an arc and drawing lines, then try making joints. Before adding one bead over another, wire-brush the scale as shown at left

SUCCESSFUL arc welding depends to a large extent on proper accessories, but with a little practice the builder of the arc welder described in previous issues (P.S.M., June '37, p. 69, July, p. 87, and Aug., p. 103) may quickly acquire the proper technique.

As mentioned in the last of those articles, it is essential that the operator protect his face with a suitable hood, and his hands with leather gloves. As an added safeguard, the operator should wear bicycle trouser guards to prevent hot particles of metal from dropping into his shoes. Since there is a tendency for curious onlookers to watch the arc with unprotected eyes, the work should be shielded wherever possible with a three-sided inclosure.

In using an arc welder for the first time, insert a short carbon rod in the holder and practice striking and holding an arc on a piece of scrap metal. When a steady arc can be maintained, practice drawing the arc along straight and curved lines. Since it is impossible to see through the special glass in the hood until the arc is burning, you will have to raise the hood to place

the carbon holder in the proper location, then lower the hood and strike the arc. If the arc is allowed to play steadily on one spot, a hole will be burned through the practice metal. This characteristic of the carbon arc may be utilized in cutting metals at a much greater speed than by mechanical means.

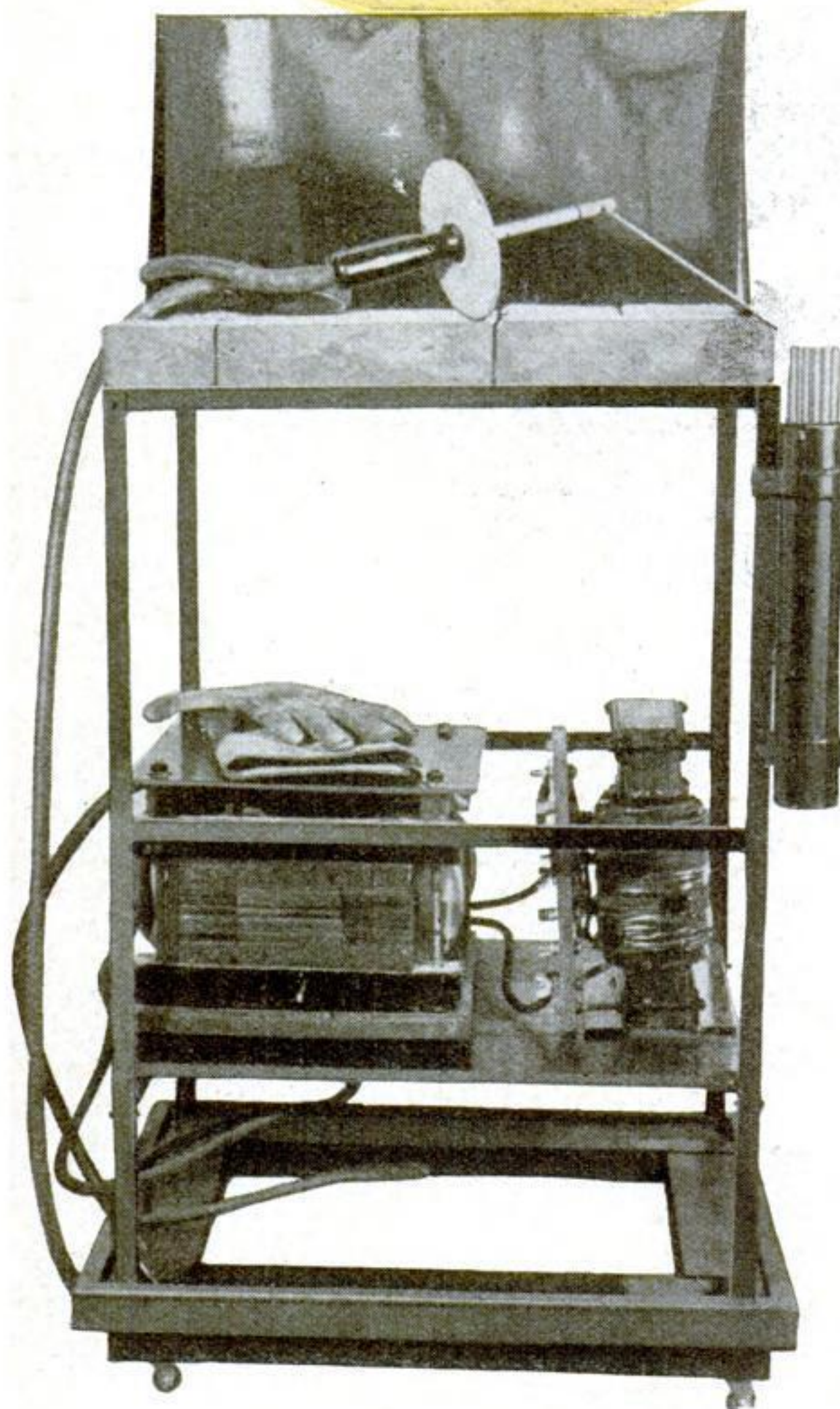
The next step is to practice feeding the welding rod into the arc and running "beads," as the deposited metal is called. Then weld scrap pieces of metal together, both parallel and at right angles to each other. On some types of jobs, where the edges of the metal run together as drawn in Fig. 1, or the ends overlap as in Fig. 2, they may be welded together without the addition of welding rod by playing the arc along the edges.

The carbon rod should be of the proper size for the amount of current being used, and it should not extend more than 4 in. beyond the holder, otherwise the heat causes the carbon to vaporize and there is considerable wastage. When using the welder at its full capacity, $\frac{1}{4}$ -in. carbon rods should be used. On jobs requiring less current, $\frac{3}{16}$ - and $\frac{5}{32}$ -in. rods may be used.

ALTHOUGH the process of carbon arc welding is extremely rapid, it is not adaptable to vertical or overhead welding, hence its applications are limited. The metallic arc is somewhat more difficult to handle than the carbon arc, but it has the advantage of being adaptable to any type of weld.

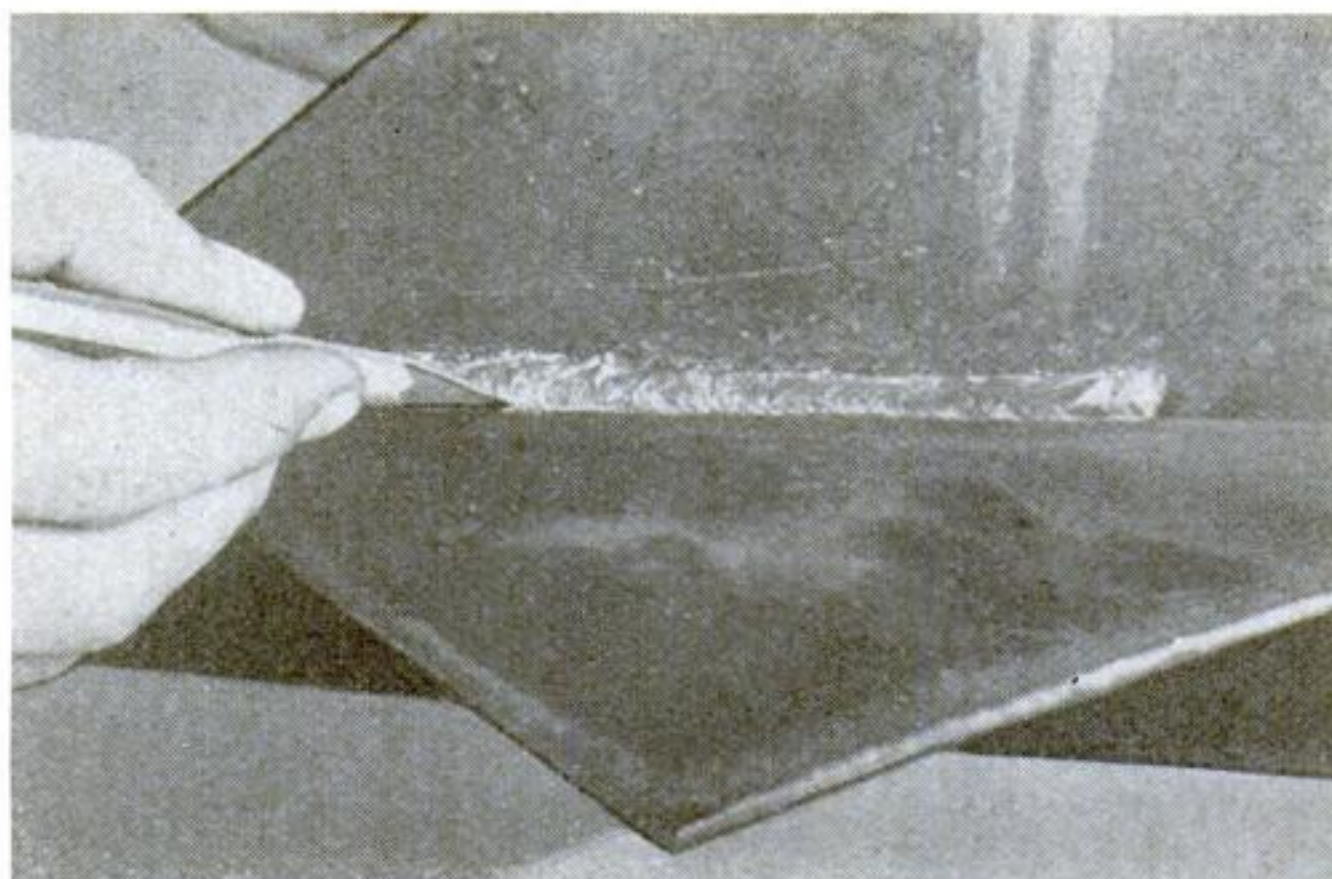
Due to the fact that the current across an alternating-current arc is reversing many times a second, some means must be provided to stabilize the arc during those periods of reversal. With the carbon arc, the vaporized carbon provides a steady path for the current, and no outside stabilizing medium is required. In metallic arc welding, the rods are usually coated with a thin coating of lime or other stabilizing substance. If the operator desires to prepare his own welding rods, he may do so by dipping the bare welding rods in the following mixture:

Dissolve 1 lb. carbide in $\frac{1}{2}$ gal. water. When the liquid ceases to bubble, pour off the surplus water until just the



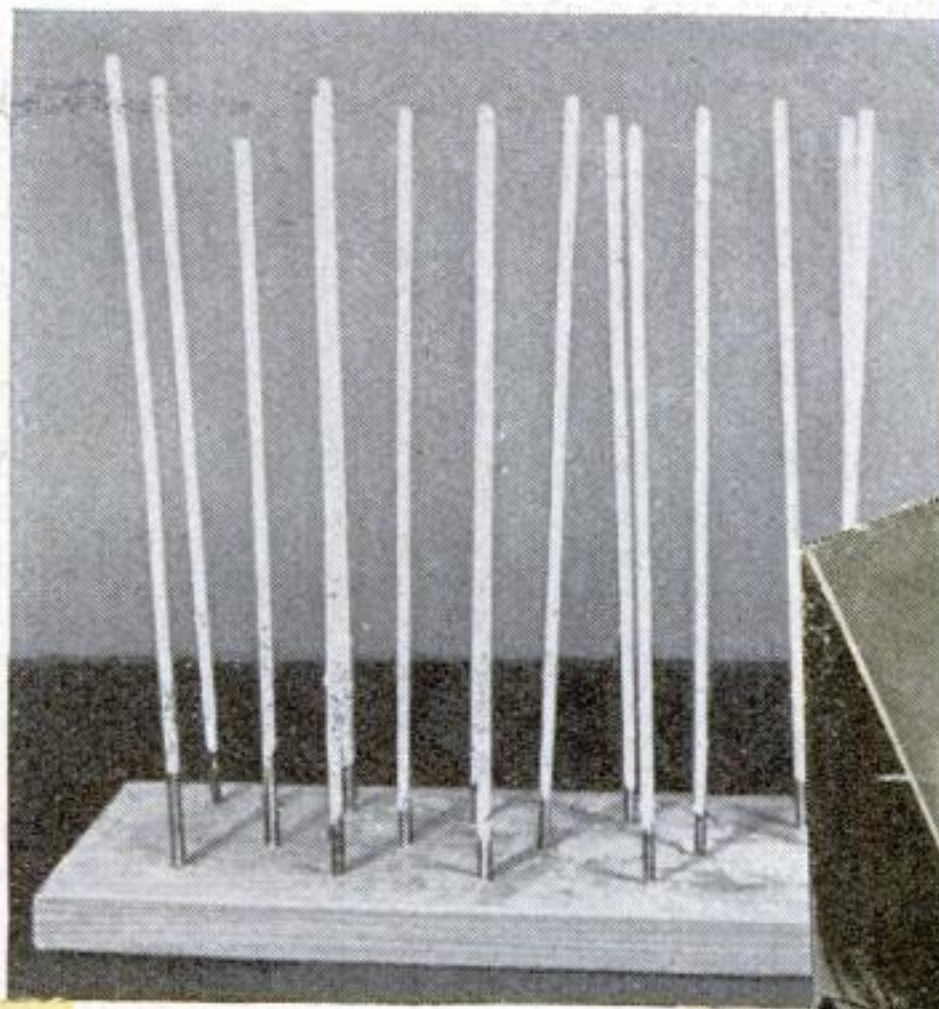
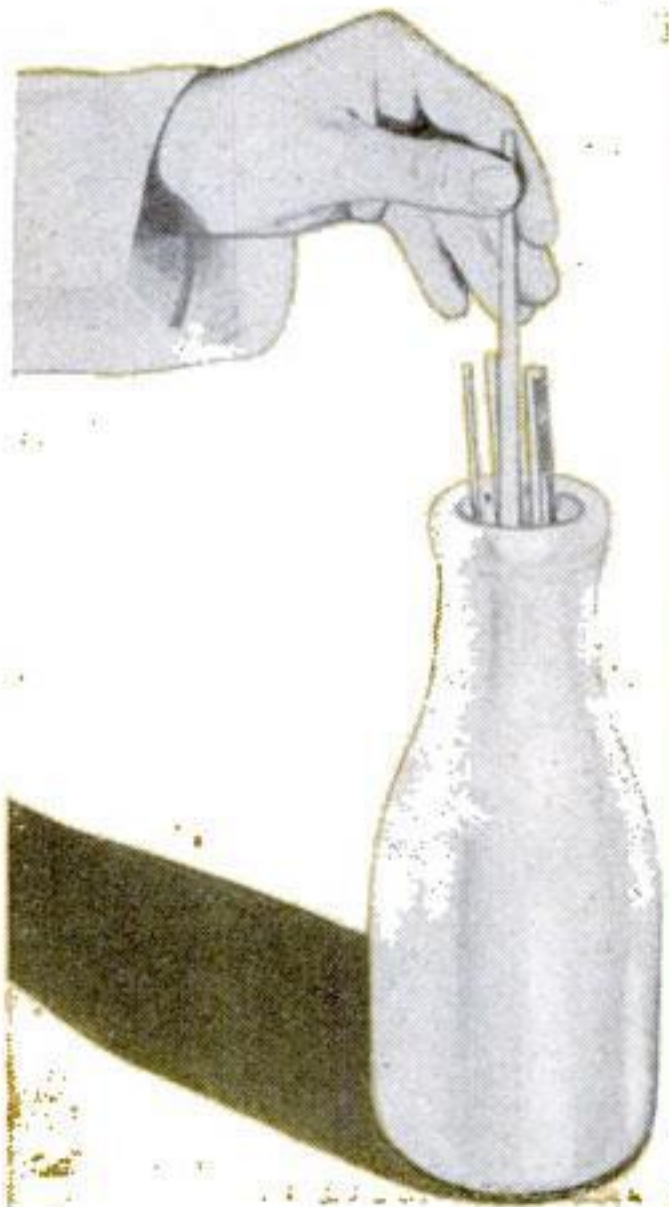
A convenient portable outfit for arc welding. This consists of the various units described in previous articles, mounted on a strong stand of welded steel

After making practice beads like that shown at the right, examine them closely. They should resemble a series of semicircular ridges about $\frac{1}{16}$ in. apart

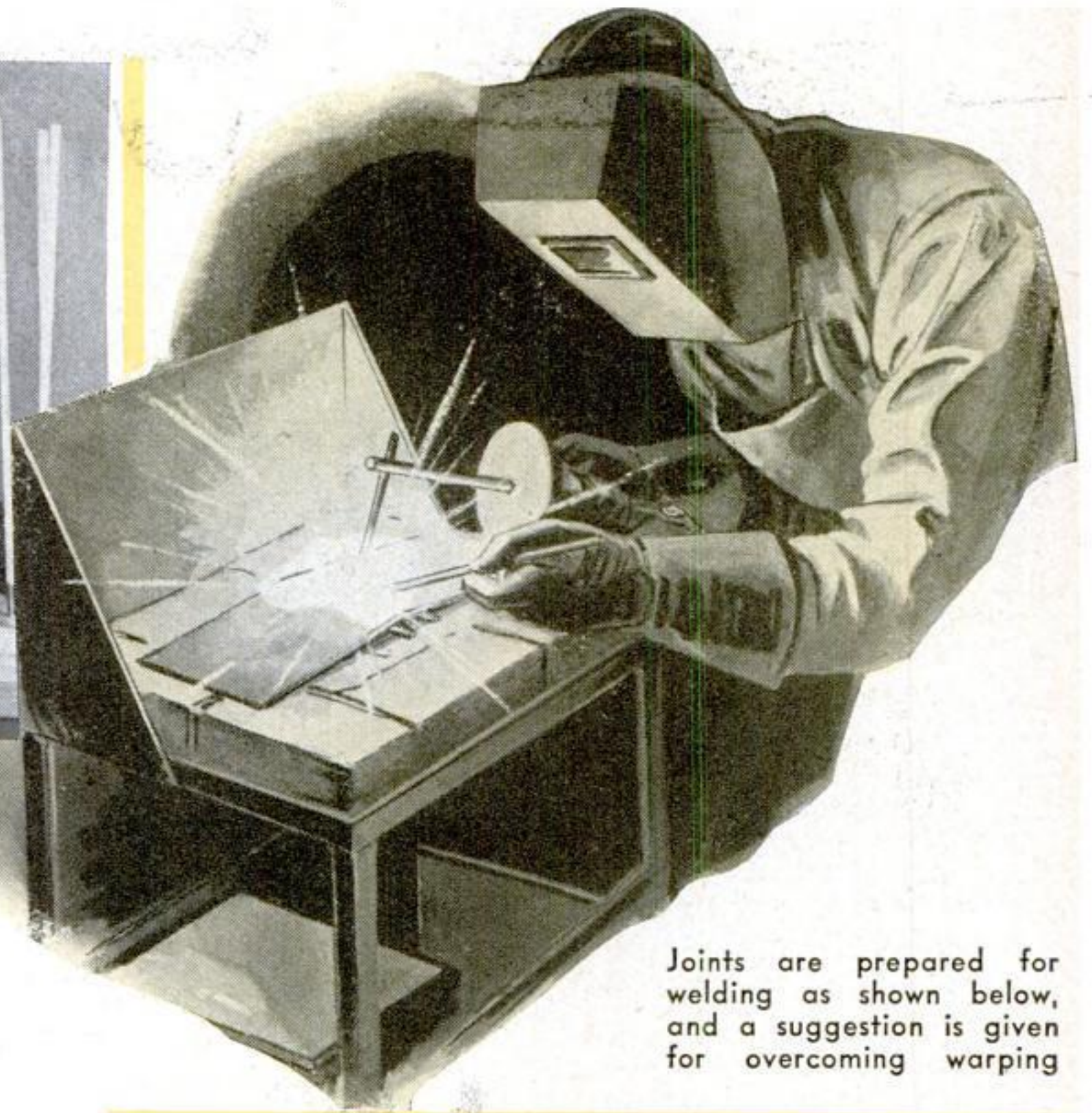


ARC WELDING

By
KENDALL
FORD



The rods for metallic arc welding usually are coated with a stabilizing substance. This may be done by dipping them into a solution prepared from carbide and water glass and then setting them upright to dry in a rack like that illustrated above



Joints are prepared for welding as shown below, and a suggestion is given for overcoming warping

creamy substance remains. Since much inflammable gas is generated while the carbide is dissolving, it is advisable to perform this operation in open air. Pour the creamy sediment into a flat container and heat over a flame until all of the moisture has been removed, then work it into a fine powder. Place the powder in a container and add enough water glass (silicate of soda) to make a mixture somewhat thicker than cream. Pour the mixture into a wide-mouthed bottle or other long, narrow container, and dip the welding rod into it, leaving about 1 in. of the bare metal exposed for clamping the rod in the holder.

If the mixture is of the proper consistency, one dipping will suffice to give the rods a smooth, uniform coating. If the mixture is too thick, it will not adhere; if too thin, the rods will have to be dipped several times and allowed to dry between the dippings. A suitable drying rack may be made by drilling a number of holes the same size as the rods partly through a flat board.

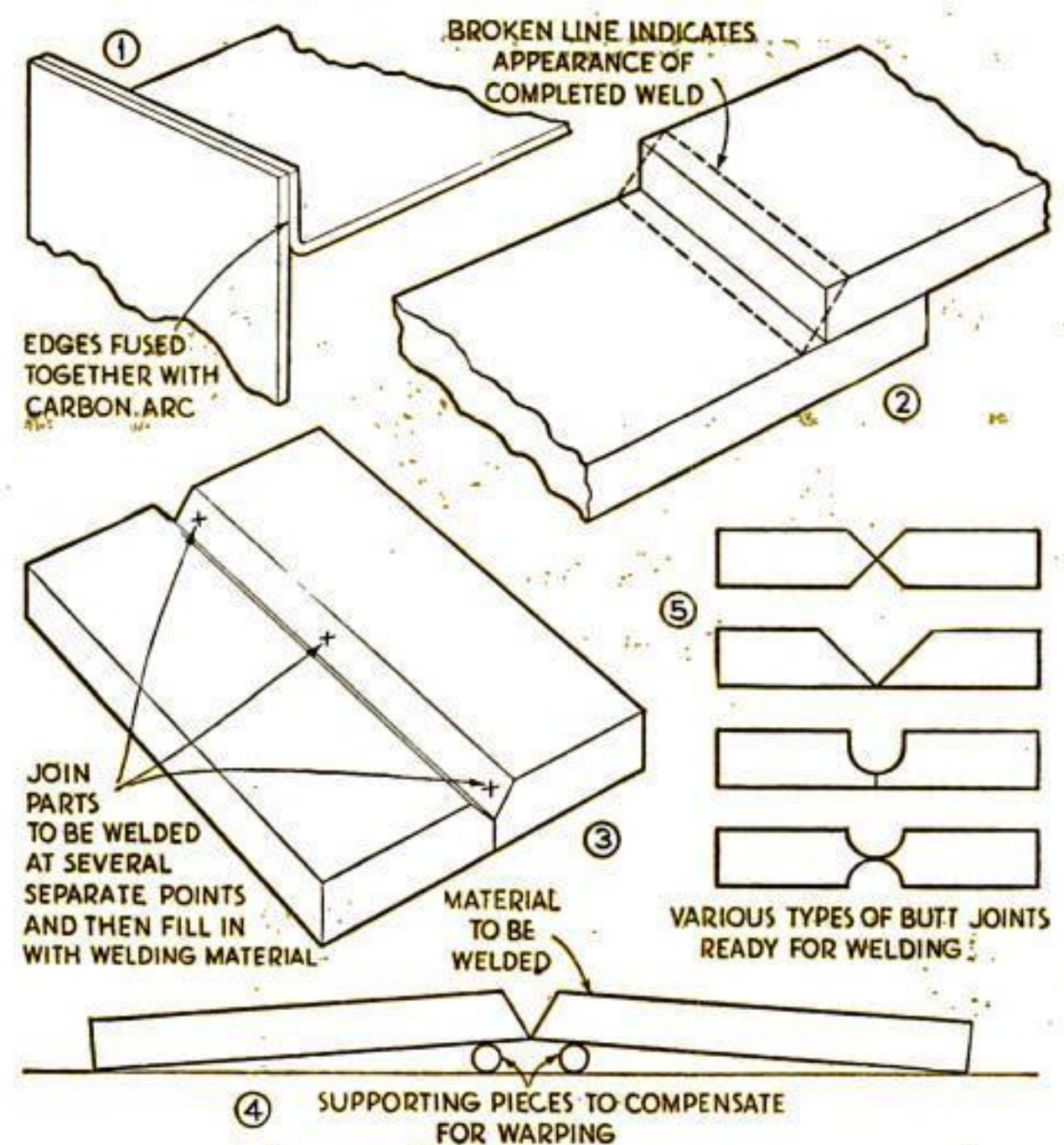
CARBIDE may be obtained at hardware stores, and water glass at drug stores. Plain welding rods may usually be obtained at garages or other shops where gas welding is done. Since the size of the welding rod will vary with the type of job, it is advisable to have a number on hand at all times, varying from $\frac{3}{32}$ to $\frac{1}{4}$ in.

When using the metallic arc for the first time, insert a dipped rod in the holder, $\frac{3}{32}$ or $\frac{1}{8}$ in. in diameter. Adjust the reactance coil for low current, and practice striking an arc on a piece of scrap metal. A beginner usually causes the welding rod to fuse to the practice metal instead of striking an

arc. That may be avoided by sweeping the welding rod across the metal with a side movement instead of allowing it to drop perpendicularly. When the trick of striking and holding an arc has been mastered, run a series of practice beads on scrap metal. Examine the deposited metal to determine if it is fusing with the scrap metal or just being left on the surface. In the latter case the bead may be easily broken away with a hammer and a cold chisel. Next practice curved lines and letters.

In making a close-up examination of a satisfactory bead, it appears as a series of semicircular ridges about $\frac{1}{16}$ in. apart. Where the deposited metal has the appearance of a rough, irregular flow, it indicates that the movement of the welding rod across the metal being welded has been too rapid.

When satisfactory beads can be made, try welding two pieces of metal together. In joining heavy pieces, build up the joint with a series of beads. The coating of scale that forms on top of each bead should be removed with a stiff wire brush before additional beads are built on. There is a tendency for the pieces to warp out of line, due to the uneven application of heat. This may be avoided by joining the parts together



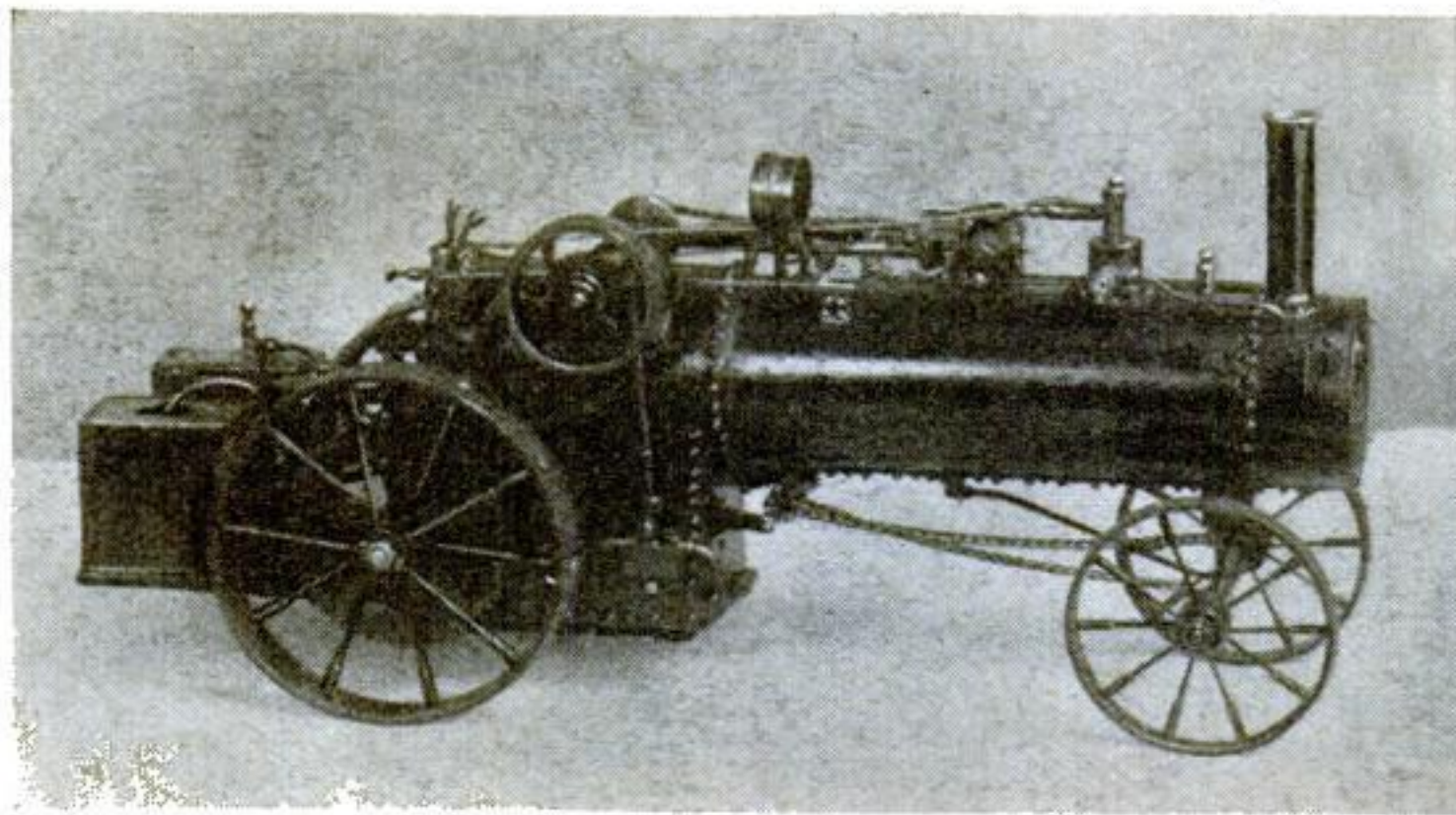
at separate points and then filling in between, as shown in Fig. 3. Warping may also be compensated for by placing the parts enough out of line at the beginning of the weld so that the warping will bring them into line, as shown in Fig. 4.

The usual methods of grinding the various types of butt joints in preparation for welding are shown in Fig. 5.

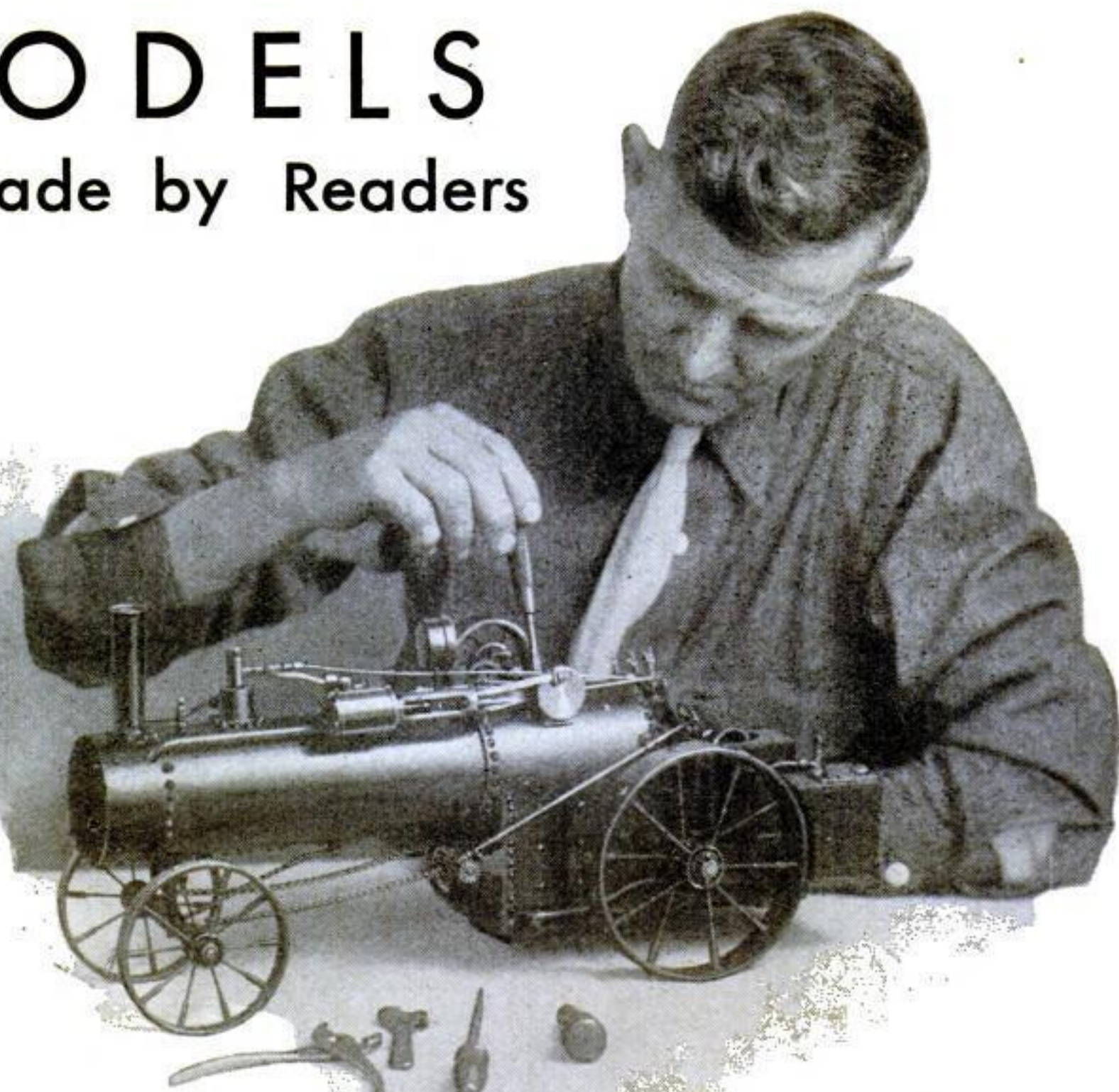
Since only practice and experience will make one a proficient welder, be prepared to use a large number of rods on practice jobs. If coated as described, they are very inexpensive. Once mastered, however, the art of electric welding will repay the operator many times for the few hours spent in learning the correct procedure.

TRACTOR MODELS

and Other Unusual Projects Made by Readers

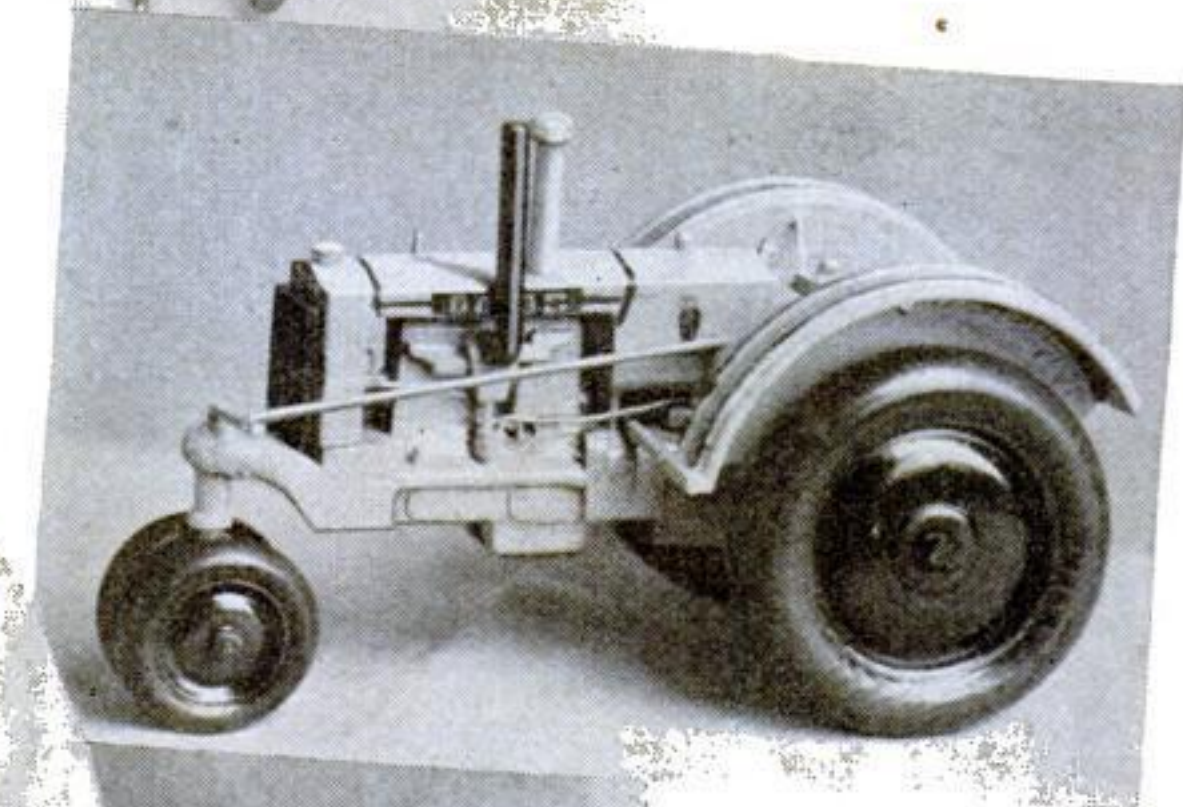
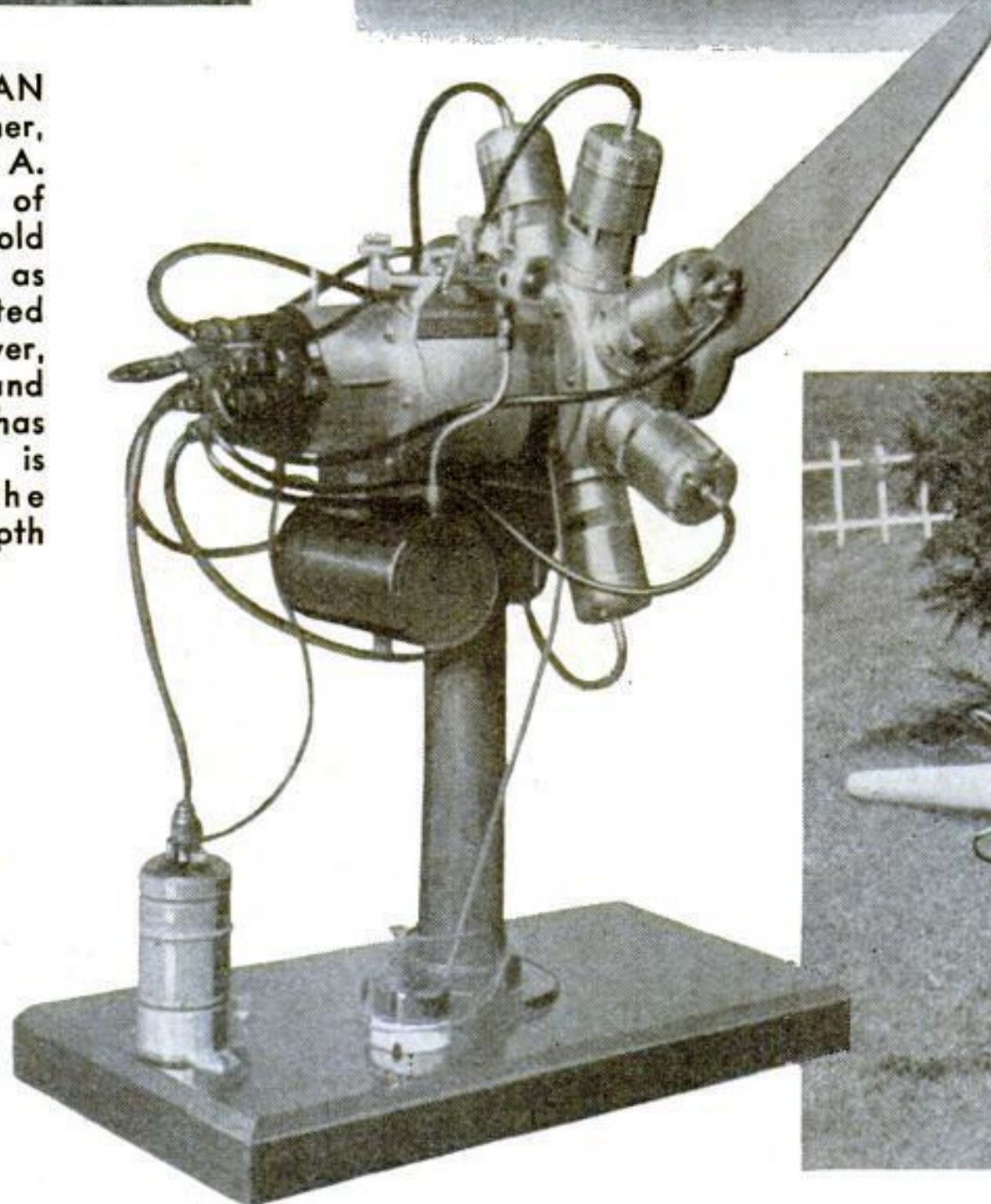


BURNING WOOD ALCOHOL as fuel, this miniature steam traction engine operates exactly like a large one. It was constructed by C. H. Beattie, of Danville, Ill. Boiler, 3 in. in diameter, 12 in. long, 10-ga. steel, has 220 rivets, twenty-six stay bolts, ten $\frac{3}{8}$ -in. copper flues; is tested to 50 lb. pressure a square inch. Details: $\frac{9}{16}$ by 1-in. cylinder; piston valve; reversing link motion; mechanical and hand water-feed pumps, mechanical lubricator, water glass, clutch in flywheel. It runs on wood floors so has no lugs on rear wheels; otherwise the model lacks nothing but a whistle

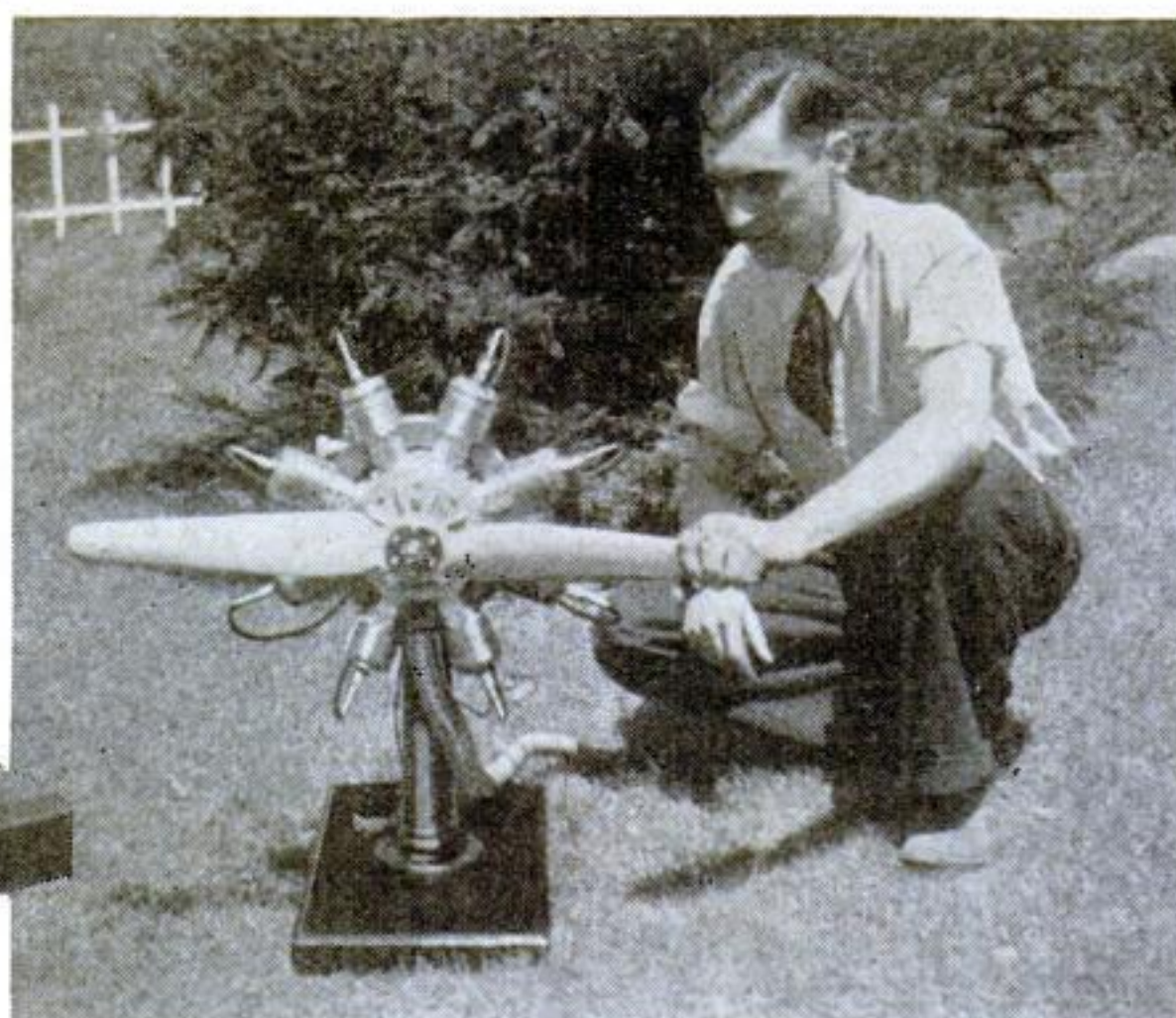


AFTER PLAYING THE ORGAN for thirty years at the Gardner, Mass., Masonic Lodge, Bryon A. Stanley, decided to build one of his own. He obtained five old reed organs, chose such parts as could be used, and constructed the case, $\frac{1}{4}$ -h.p. turbine blower, pedals, and all the bellows and wind chests. The instrument has two manuals and pedals. It is 6 ft. high, 4 ft. across the front, and nearly 3 ft. in depth

HIS FRIENDS TOLD HIM an eight-cylinder, two-cycle radial gasoline motor was impracticable, but Edmund Freund, of Iowa City, Iowa, successfully built one after two years' work. He made all patterns, many of the aluminum castings, and did all the machining. Of $1\frac{1}{4}$ -in. bore, $1\frac{3}{8}$ -in. stroke, the supercharged motor delivers about 5 h.p. at 1,500 r.p.m.



SPANISH GALLEONS and other fancy models never appealed much to John A. Neumann, so he carves tiny wooden replicas of tractors, separators, and other machinery on his Wood Lake, Minn., farm, all to the scale of 1 in. equals 10 in. A tractor model like that shown in the rectangle takes fifty hours



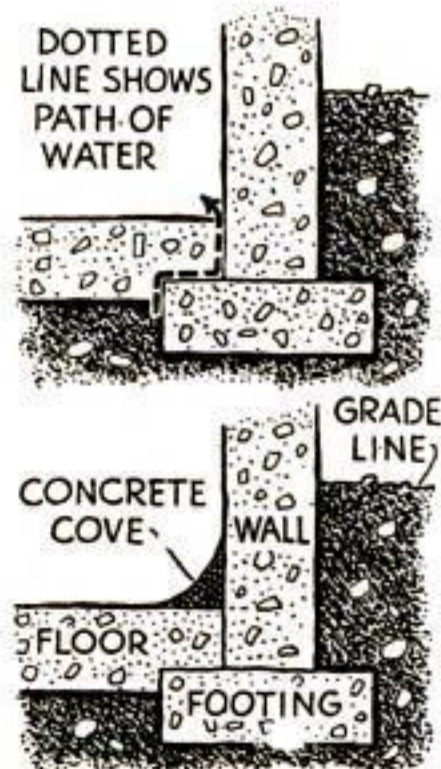
First Aid for Damp Cellars

AND OTHER SHIPSHAPE HOME HINTS

IF YOUR cellar is damp or even wet after a heavy rain or a long thaw, possibly a few simple and inexpensive repairs will remedy the conditions. First, however, check the grading to be sure that surface water drains away from the house, and make certain that the drains are not clogged up.

The cellar walls and floor should next be checked for cracks. If any are found, they should be widened out and deepened with a hammer and chisel. Of course, if the cracks are numerous and large parts of the walls or floor are loose, the repairs needed will probably be beyond the ability of the average handy man.

Aside from cracks, the place most likely to need attention is the point where the walls join the floor. Water often seeps into the cellar by the path shown by the dotted line in the first diagram.



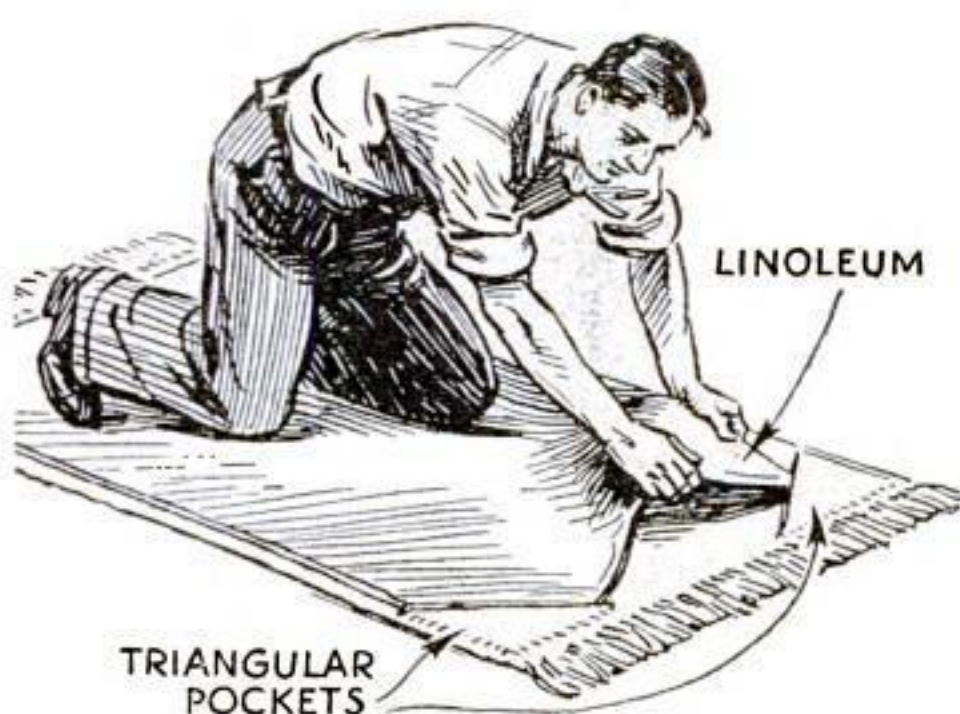
Where water often leaks in and how it may be checked by applying concrete

The remedy for this condition is to make a waterproof cove all around the inside of the cellar as shown in the second diagram. If necessary, this cove can be extended up the walls for a foot or two as a sort of wainscoting.

All loose particles should be removed from the surfaces being repaired with a stiff wire brush, and any traces of oil or grease must be fully removed with naphtha or gasoline. A waterproofing compound should be added to the concrete mixture to stop water seepage and aid in bonding the new concrete to the old. There are many good waterproofing compounds on the market, but my preference is for emulsified asphalt, (Continued on page 127)



Before it sets, the concrete, which is mixed with a waterproofing compound, is troweled to a neat finish

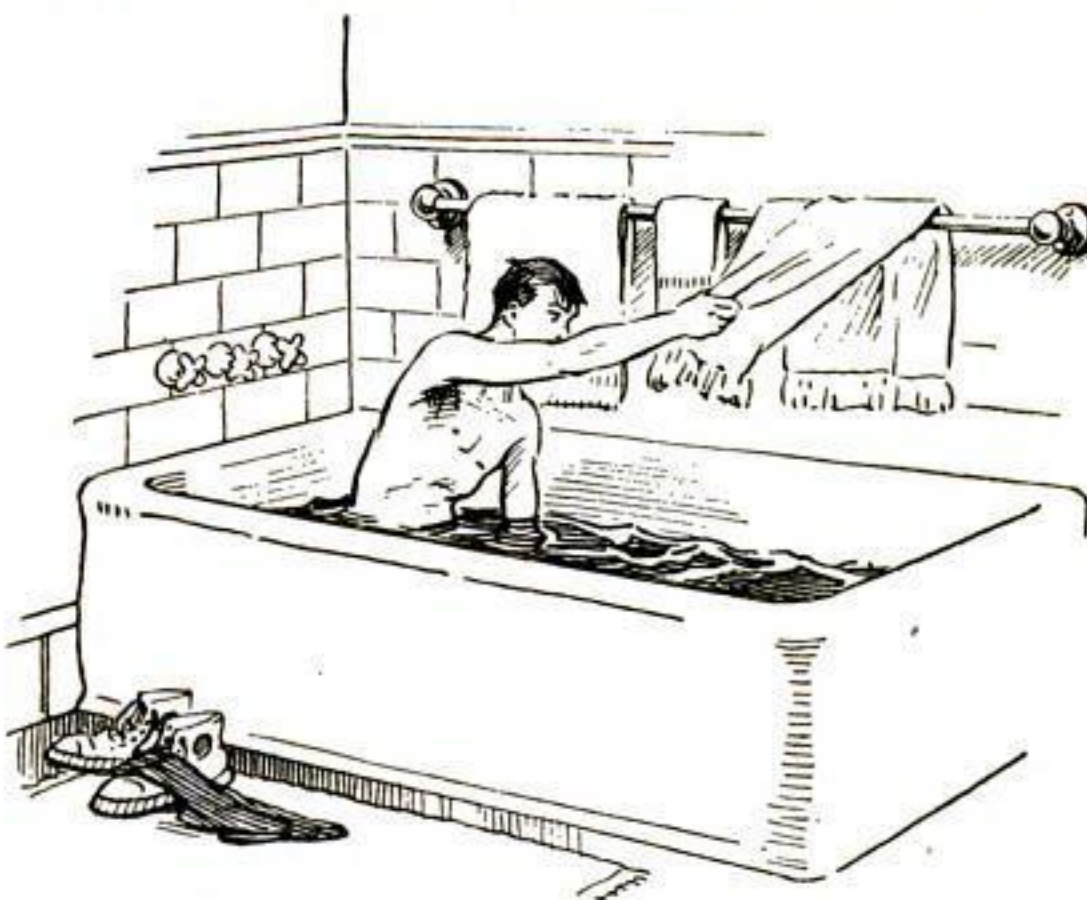


Linoleum Backing Keeps Soft Rug Lying Flat

THIN, soft rugs may be reënforced so as to lie flat on the floor by backing them with linoleum. Four triangular canvas pockets are sewed to the back of the rug about 1 in. away from the edges to hold the corners of the linoleum, which can easily be removed to permit the rug to be cleaned whenever desired.—AXEL E. OGREN.

How to Soak Off Old Wall Paper Without Too Many Drips

OLD wall paper can be removed quickly by wetting it well with warm water, but don't try to use an ordinary sponge for this purpose. It results in a deluge, especially when applied to a papered ceiling. Use either the new type cellulose sponge or a lamb's-wool duster of the kind that is worn like a mitten and obtainable at most ten-cent stores. They wet a larger area than a common sponge and don't drip.—E. E. BURGESS.

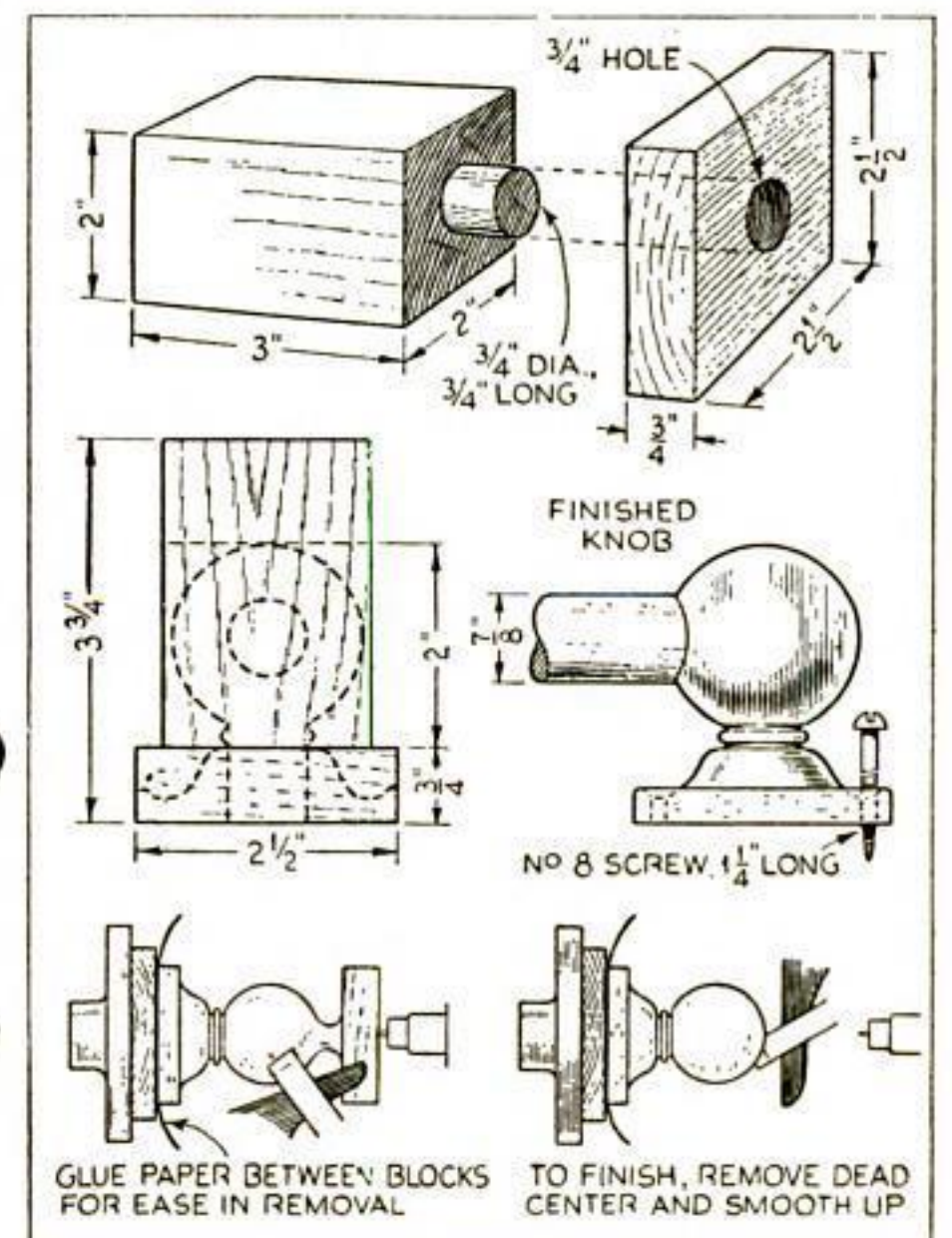


Long Towel Bar of Enameled Pipe

COMMERCIAL towel bars are usually too small to hang several towels in line, and it is often impossible to get one the correct length for the space available in the bathroom. An inexpensive substitute may be made from common 1/2-in. galvanized pipe, which has an outside diameter of about 7/8 in. The pipe must be sanded perfectly smooth and given a number of coats of high-grade enamel of the color used in the decorative scheme. Each coat is rubbed down, the final coat with fine powdered pumice or rottenstone. This should give a glasslike finish, of sufficient depth and hardness to wear for many years.

The ends that are to retain the rod are turned up from two pieces of hardwood such as oak, maple, or birch. They are made in two parts for strength. The usual wooden commercial fittings

are not so made and are likely to break off on the end grain where the screws go into the wall. The shape of the ends may be in general like the illustration, but of course the base should be turned, if necessary, to fit the wood trim on the wall to which such towel holders are often attached. The ends are enameled and polished while still on the lathe faceplate.—J. I. SOWERS.



Neat, durable towel racks of any length desired may be made from 1/2-in. galvanized pipe and turned wooden end pieces

ODD JOBS...here are a

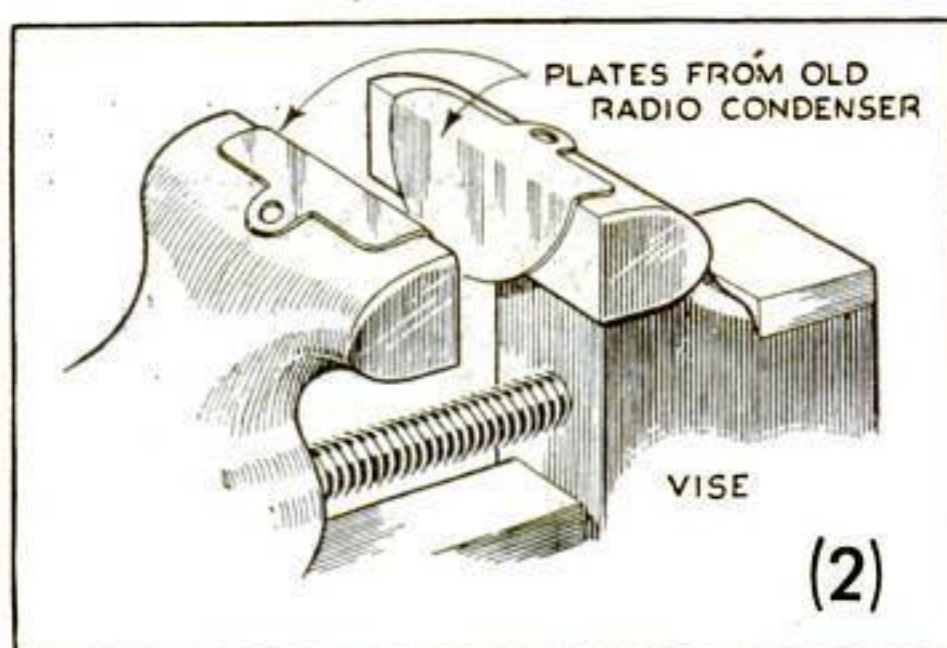


Flowerpot Trellis Made with Coat Hangers

(1) When a light trellis is required to support a vine growing in a flowerpot, it may be made from a single wooden stake and a number of discarded wire clothes hangers. After their hooks have been clipped off, the hangers are attached to the stake with staples as shown.—G. E. HENDRICKSON.

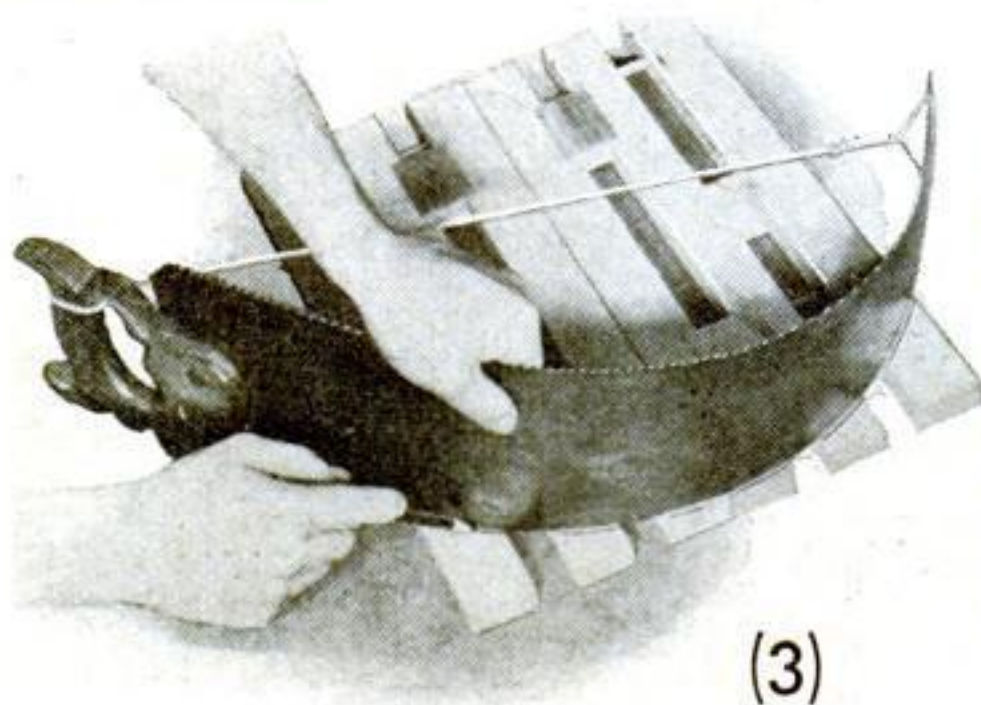
Old Condenser Plates Pad Jaws of Vise

(2) The aluminum plates from discarded radio condensers make good auxiliary "soft jaws" for small vises. They are merely bent around the jaws as shown. When not needed, they can be hung up by the holes in the plates.



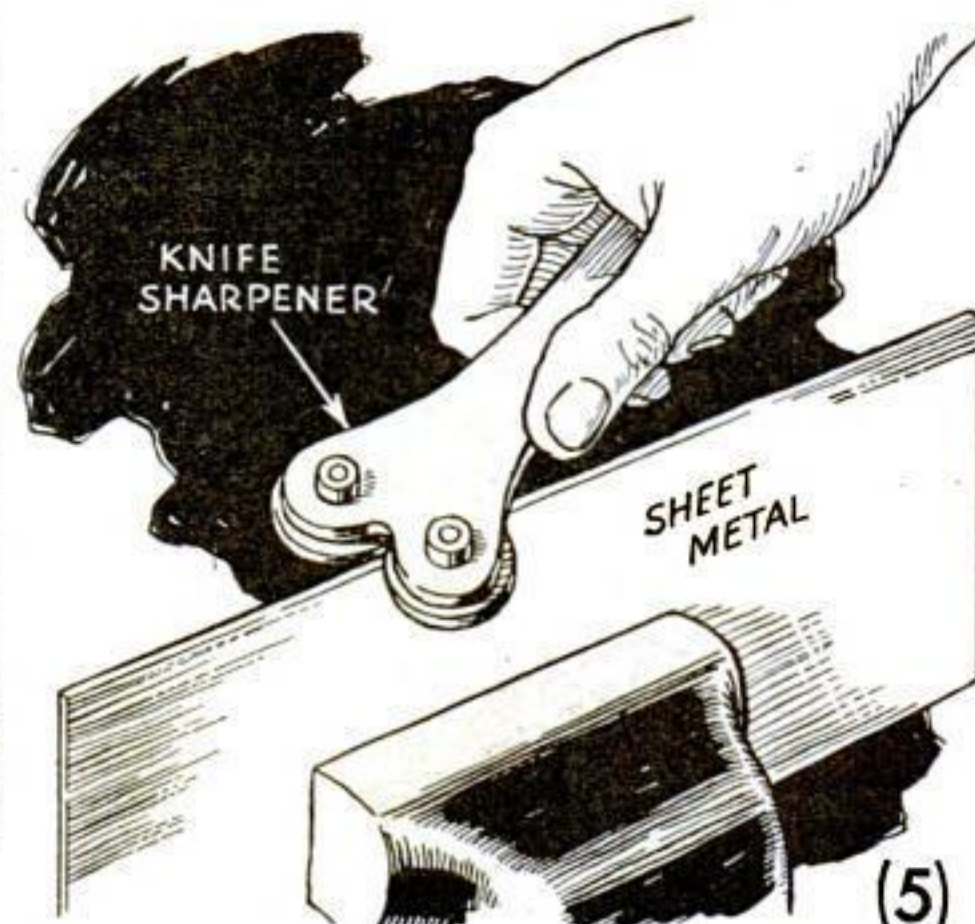
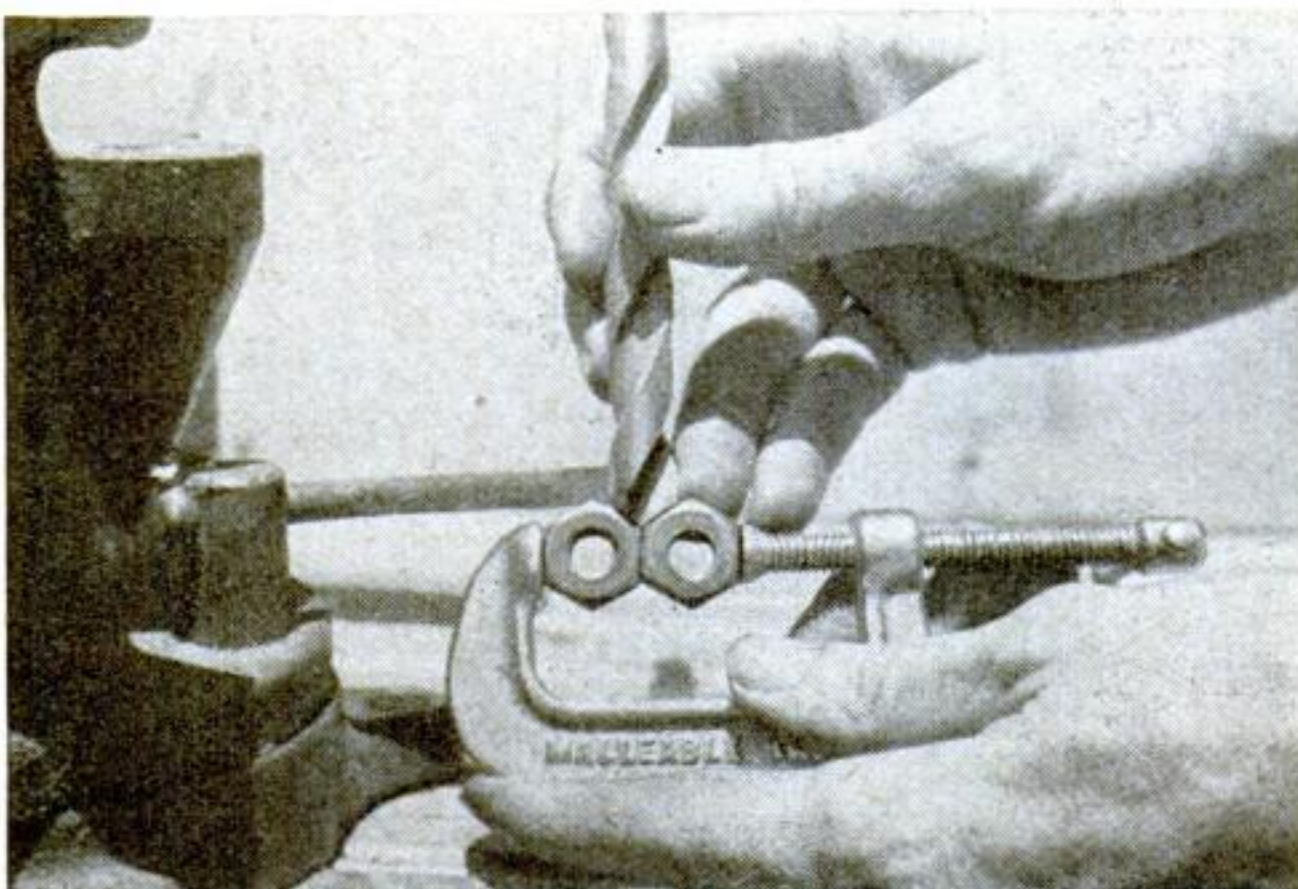
Bent Handsaw Is Guide for Drawing Curves

(3) Curves of large radii may be laid out on various woodworking and furniture projects by using a full-size rip or crosscut saw in the manner illustrated. The saw is bent to the desired shape and held taut with strong cord. The back of the saw is then pressed against the work, and the outline is marked with a pencil.—C. ELMER BLACK.



Two Hexagon Nuts Form Drill-Grinding Gauge

(4) In case no regular drill-grinding gauge is at hand, a substitute may be made in a moment's time from two medium-sized hexagon nuts. For temporary use these nuts may be held as shown in a clamp or vise. The angle formed by the sides adjacent to those in contact is 120 deg., which is so near the strictly correct one of 118 deg. that it serves all practical purposes. For a permanent gauge of this type, braze or solder the nuts together.—W. C. W.



OCCASIONALLY you hear of a shop kink so curious that you make a mental note to try it at the first opportunity. You'd never think, for example, that an onion will aid in gluing leather to metal. Arthur Berchak, one of our readers, didn't think so either, but he had it demonstrated to him by an old mechanic who learned the trick in Germany when building organs. Simply cut an onion in half and rub it over the surface of the iron or other metal; then glue and clamp the leather to it just as if two pieces of wood were being fastened. Use hot glue for best results, although any high-grade cold or liquid glue is also satisfactory. Allow twenty-four hours for drying.

Knife Sharpener Burs Sheet-Metal Edges

(5) Sharp sheet-metal edges can be effectively burred by means of a disk knife sharpener of the type illustrated. The results are not only more uniform, but the work can be done in a fraction of the time required to file or otherwise remove sharp edges.—P. R.

Cutting a Coil Spring into Short Pieces

(6) When a number of short coil springs have to be cut with a cold chisel from a roll of stock spring, the pieces can be prevented from flying off the bench by opening up a spring cotter and inserting it in the end of the spring as shown. The small piece may jump when cut off, but it will merely turn over the length of the cotter key.—F. B.

Cement from Celluloid Toothbrush Handles

(7) For repairing colored dressing-table sets and similar celluloid articles, a cement of almost any required color may be made by dissolving pieces of celluloid toothbrush handle in a suitable solvent. Choose a handle of a color to match the article and, if necessary, mix pieces from two differently colored handles to get the right tint. Acetone is a satisfactory solvent, but if you wish the cement to dry slowly, use equal parts of acetone and amyl acetate. It takes some time for the celluloid to dissolve, so mix the cement a day or two before you intend to use it. Prepare it in a glass jar and stir the mixture occasionally. It is good practice to keep a supply of old handles.—K. L. R.

dozen easy ways to do them

Hand Grinder Gives Metal Fine Finish

(8) Metal may be given a so-called "mill finish" of the type shown by using a hand grinder or a drill press. A wooden plug is first prepared with a flat face covered with hard felt, sheet rubber, or leather. This tool is mounted so it may be held in the chuck. The metal to be finished is first oiled, then sprinkled with powdered abrasive and lightly ground.—JOHN S. WILCOX.

How to Screw Fixtures to a Plastered Wall

(9) When it is desired to fasten shelf supports, brackets, or other fixtures of moderate weight to a plastered wall, and the studding is not in the right location, the object can be screwed to the laths, if they are of wood. The lath, plaster, and the object itself are then clamped tightly together as shown, making a reasonably secure support; and the plaster will not loosen or crack because no hammering is necessary. The same holes in the wall can be used when replacing the object after repainting or papering.

Laths can be located by drilling into the wall with a very fine drill. If you strike in between laths and have to drill a second hole, the first hole is so small that it is not noticeable and usually will be covered by the object itself. The hole must be enlarged, of course, to suit the size of screw used for the fixture.—H. RAMBOW.

Ordinary Steel Twist Drill Bores Holes in Glass

(10) Amateur mechanics usually avoid glass-drilling jobs or else go to considerable trouble to rig up some sort of special tubular device for grinding the holes. It is much simpler merely to use a good quality, standard steel twist drill of the required size. The cutting edge of the drill is ground sharp as if it were to be used for drilling steel, and the edge is slightly relieved about 0.005 in. as shown to prevent seizing. A small

hand drill will do the work nicely. No center marks or pilot holes are required, but a wash of turpentine should be applied with a brush. The drill leaves a clean, sharp hole. Stock for mirrors and plate-glass panels may be speedily drilled in this way.—O. R. MATTHEWS.

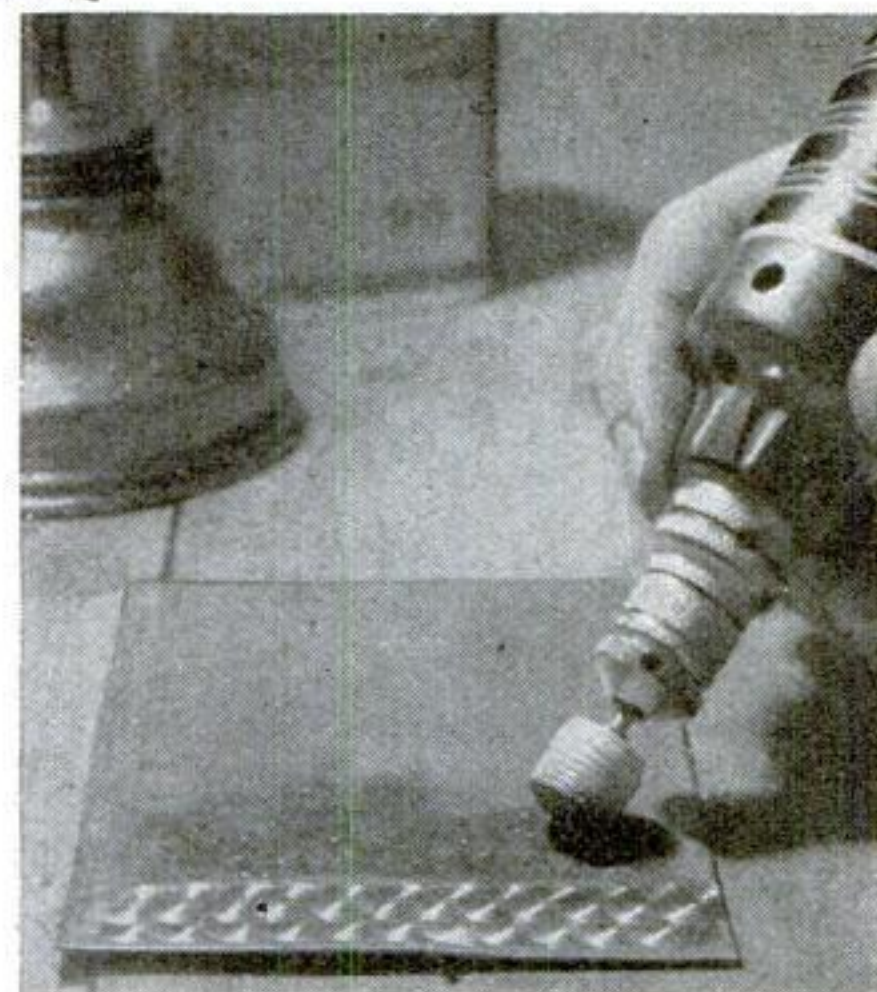
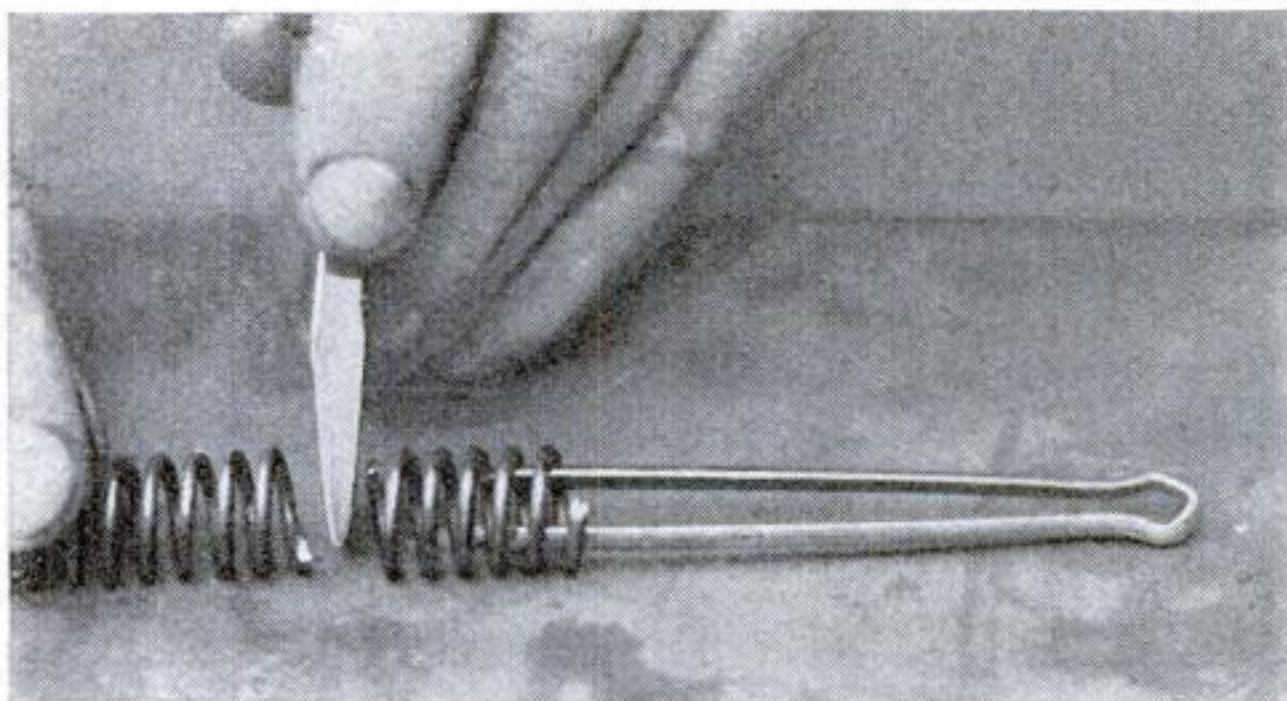
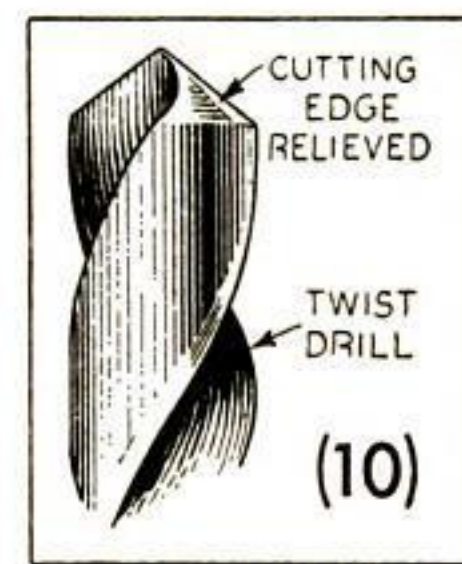
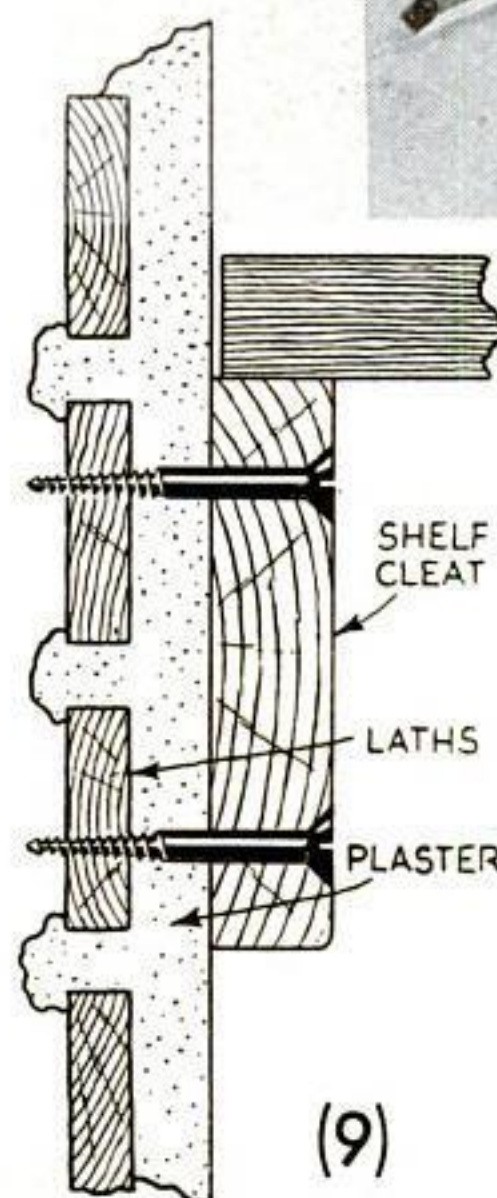
Old Pocketknife Blades Ground into Chisels

(11) Pocketknives with broken blades can be converted into excellent little chisels for very delicate repair work and model making. All that is necessary is to grind the broken blade or blades to shape, care being taken not to overheat the steel and ruin the temper. One of the writer's old knives has a blade ground to a $\frac{1}{8}$ -in. chisel point, and another blade to $\frac{3}{16}$ in. The regular handle is used for the chisel's grip.—THEODORE R. SWAYZE.

Extra Handle Improves Heavy Floor Brush

(12) Dairymen who have to scrub and scour the cement floors of milk rooms will find that if a short length of pipe with a pipe "T" is slipped over the scrub-brush handle as shown, it will enable them to apply more force and weight to the bristles and do faster work. Twisting the pipe into the "T" attaches the piece securely to the handle where most convenient.—G. E. H.

NOW THEN . . . do you know some good ways to do those never-ending odd jobs every handy man has to tackle? If so, why don't you send them to us? We pay on acceptance for every contribution of this type found available for publication.



Circus Tank Wagons

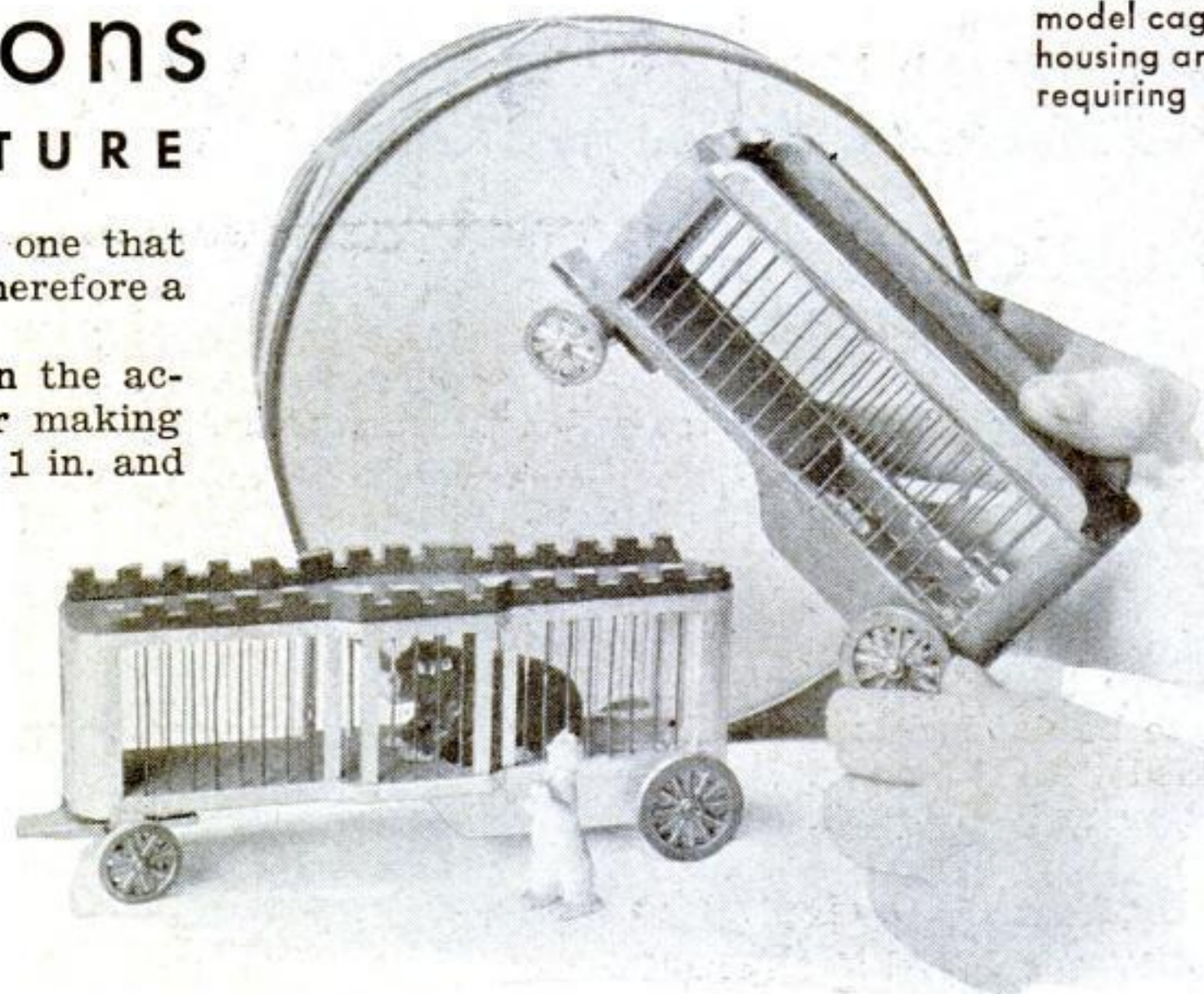
CONSTRUCTED IN MINIATURE

NO CIRCUS wagon attracts more attention than the one that houses the hippopotamus. A wagon of this type is therefore a good subject for the model maker.

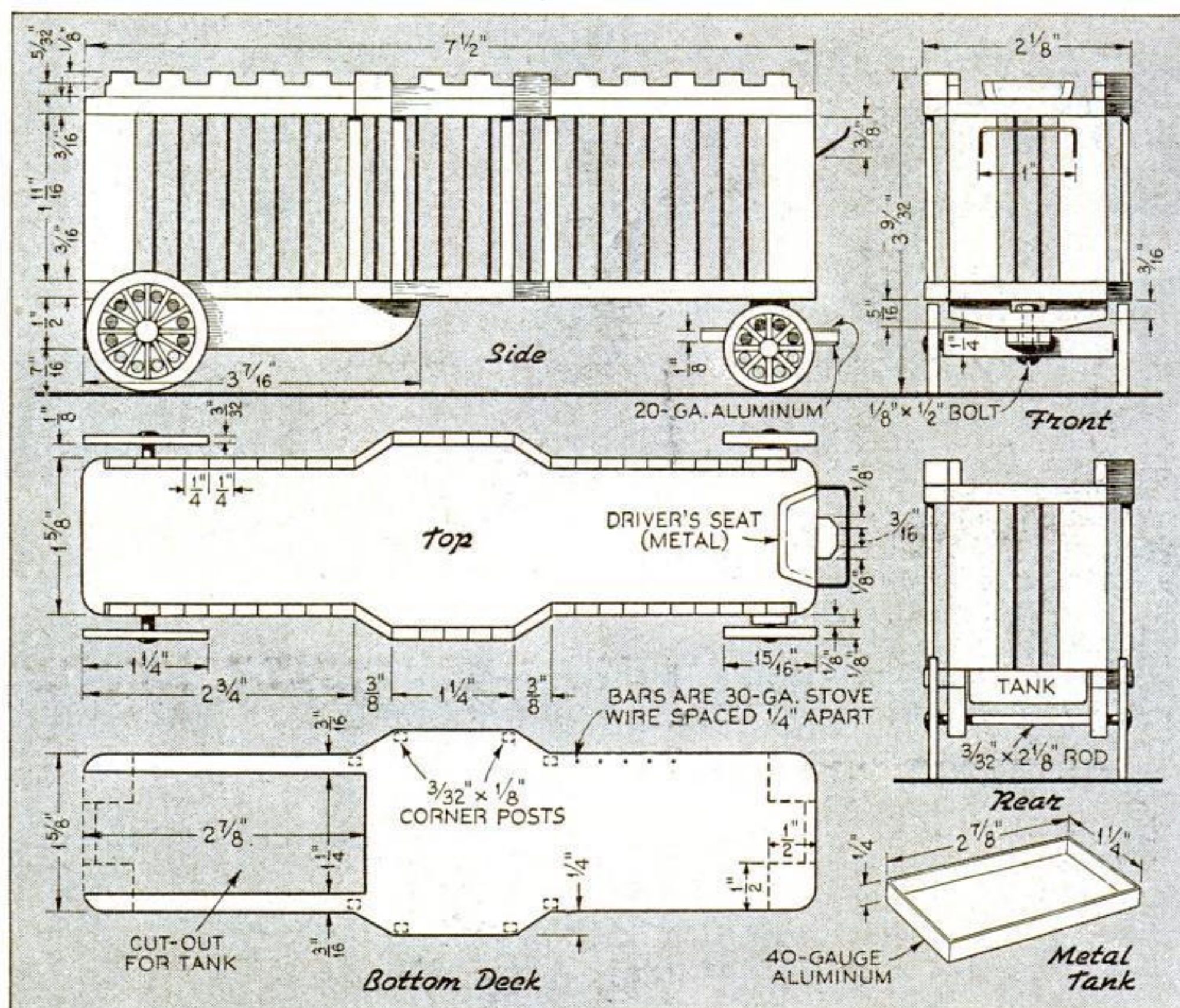
Plans for a miniature hippopotamus wagon are given in the accompanying drawings. The same plans may be used for making polar bear and seal wagons provided the body is shortened 1 in. and the bulge in the center omitted.

The wheels may be cast from lead in wooden molds as described in a previous article ("Circus Wagons in Miniature," P.S.M., April '37, p. 90). The water tank is cut from 40-gauge aluminum and the piece annealed over a flame before being folded. The tank should be fastened to the deck before the remainder of the body is assembled.

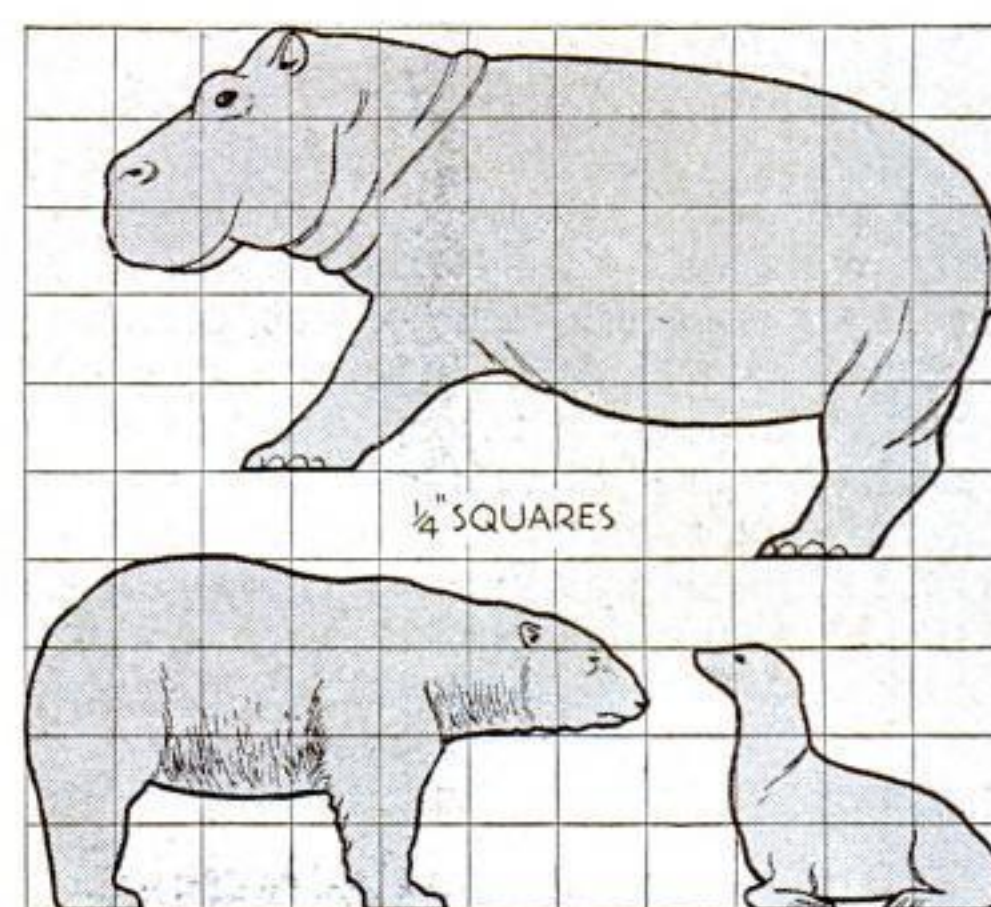
An eight-horse team is used to pull the hippo wagon, but six horses are sufficient for seal and polar bear wagons.—GEORGE L. COLE.



Two styles of model cages for housing animals requiring tanks



Plans for the hippopotamus wagon. For other animals, omit the bulge and shorten 1 in.



Designs for carving a hippopotamus, seal, and polar bear from a piece of white pine

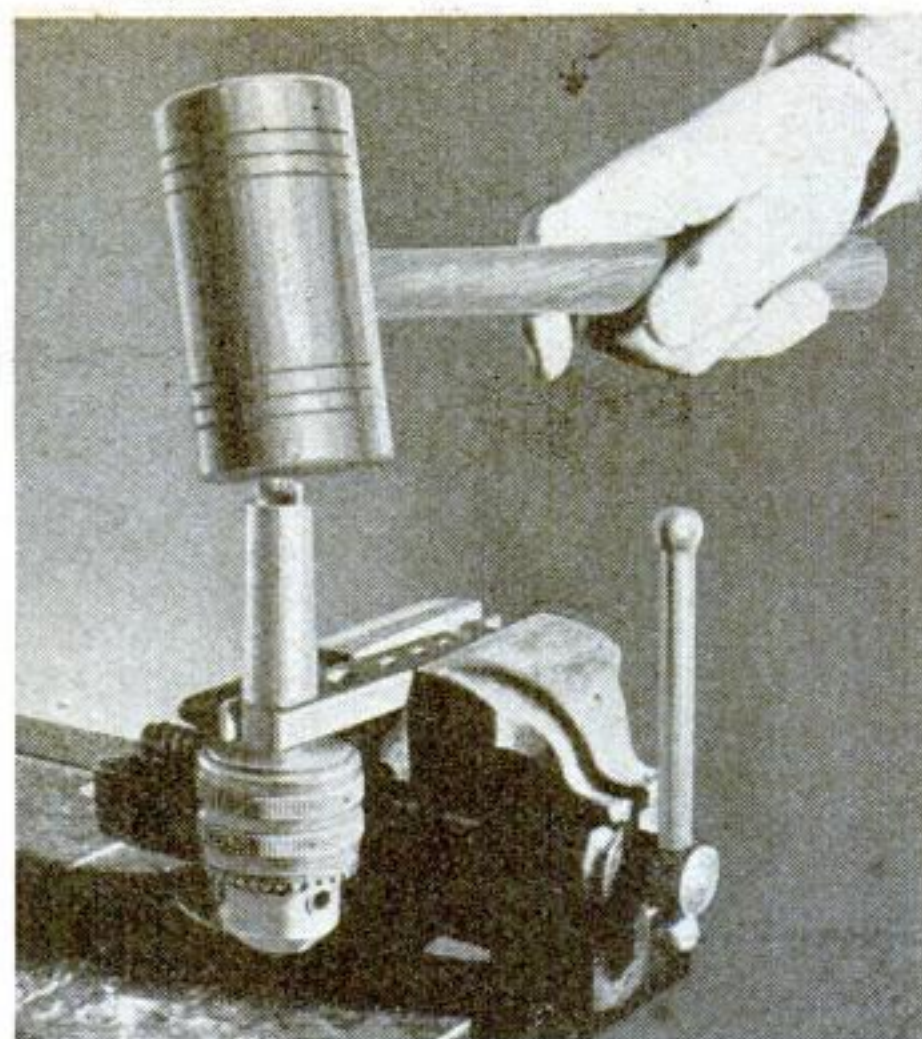
Reaching an Awkward Nut Inside Tractor Tread

TO AVOID having to get down under a tractor to tighten the inner track tension nut, drill a hole near the end of one track shoe and insert a wrench with a long shank, first moving the machine to line up the hole with the nut, as shown. This saves much time and effort.—JOSEPH C. COYLE.

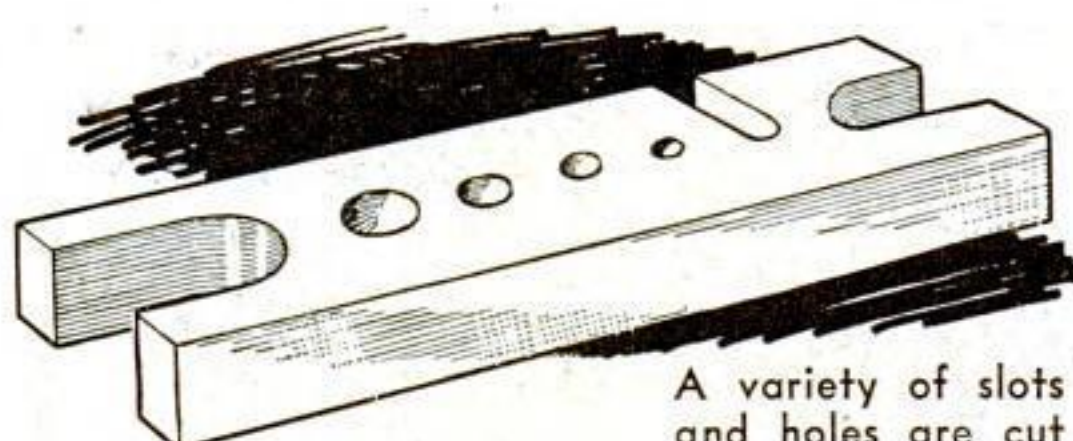


Inner track nut is tightened through hole

Steel Knock-Out Block Is Aid in Shop



Loosening the drill chuck from the sleeve



A variety of slots and holes are cut

A STEEL knock-out block of the type illustrated is a timesaver in such work as driving out pins, loosening pulleys and sleeves, and inserting shafts. It may be made from a piece of 1/2-in. flat steel, squared so that it can be gripped securely.

One reason for making the block shown was to loosen the headstock sleeve from the drill chuck. These two parts had a habit of freezing together when I did heavy drilling.—B. K.

Special Ways to Use Glue



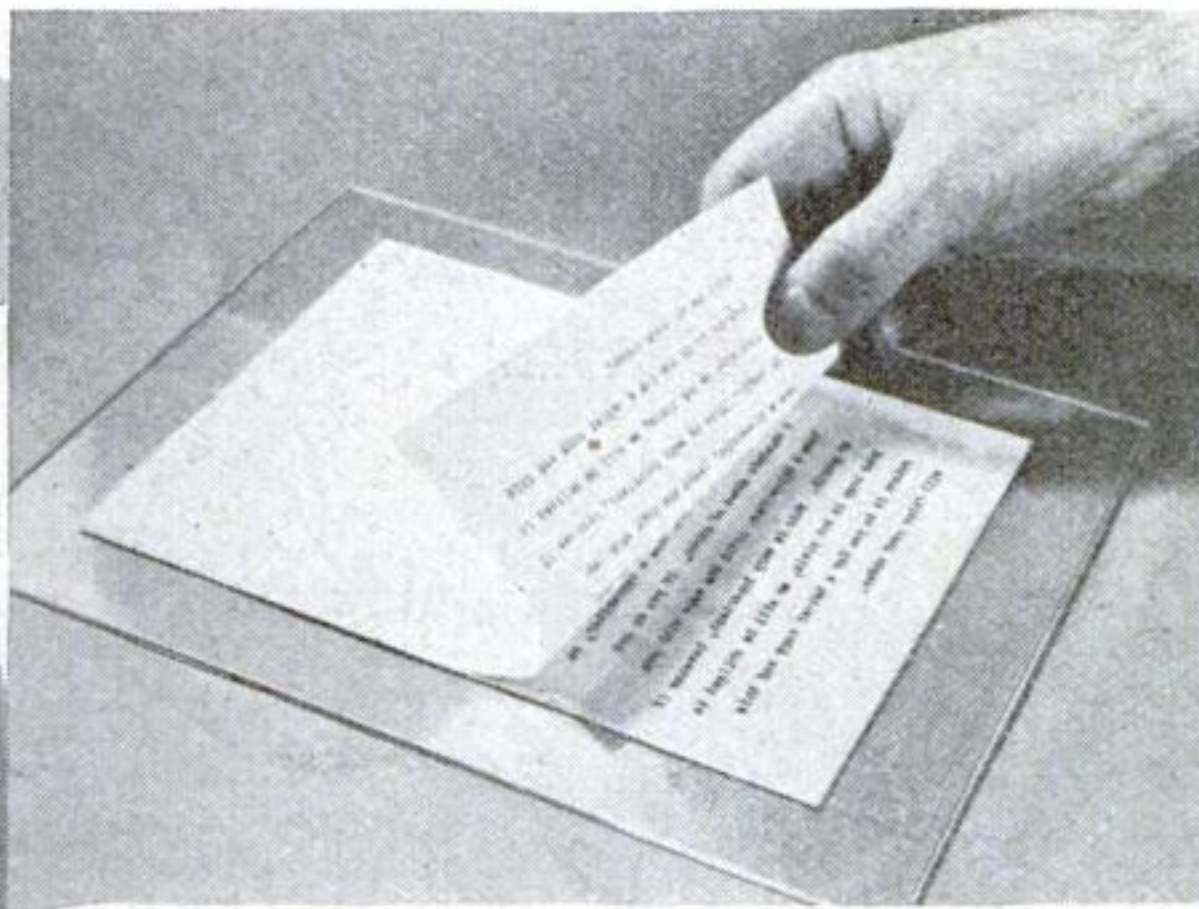
By
KENNETH MURRAY

PROBABLY you think of glue only when a chair comes apart at an embarrassing moment or when there is a project to be put together in the home workshop, but there are a number of other ways in which glue may be used.

The glue referred to is the common variety sold in flake or granular form—really an impure grade of gelatin. A water bath for heating it will be required. In the simplest form, this consists of two ten-cent cooking pans. Attach four bolts to the rim of one, as shown, to support the other pan. The lower pan is partly filled with water and heated on a small electric or gas stove, and the glue mixture is melted in the upper one.

Glue varies according to the amount of water it will absorb, so the formula for any mixture is best determined by experiment unless you know what the manufacturer recommends. To make the basic mixture, place a sufficient quantity of dry glue in the pan and add as much glycerin and water solution as it will absorb. Equal parts of glycerin and water are satisfactory, or the proportions may be altered according to the purpose of the mixture. It will melt and form a thick, tacky liquid when the water in the other pan is heated. On cooling it will "set," but will not become dry and hard.

The basic mixture, or one with less water, is suitable for either of the three styles of hecto-

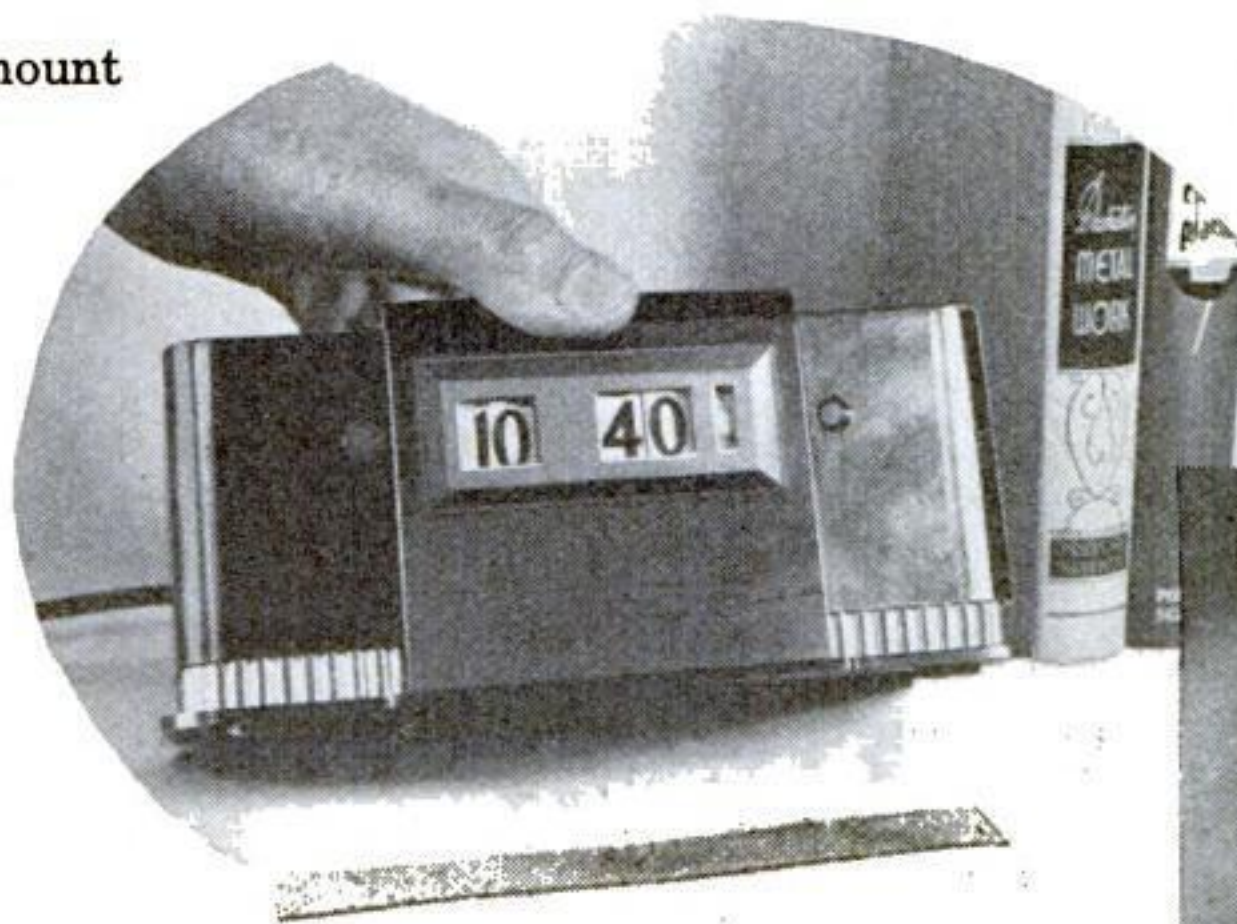


At left, making a hectograph by pouring a glue composition into a shallow pan. Above, even tough paper will act as a duplicator pad, and both sides may be coated to give double service. It should be set on glass

graphs illustrated. Make the original with hectograph ink (or typewriter ribbon) and rub it into smooth contact with the surface of the pad. As the paper is carefully stripped off, most of the ink will be transferred to the glue, and copies are then made by pressing sheets of paper in contact with the pad. As many as fifty good copies may be pulled.

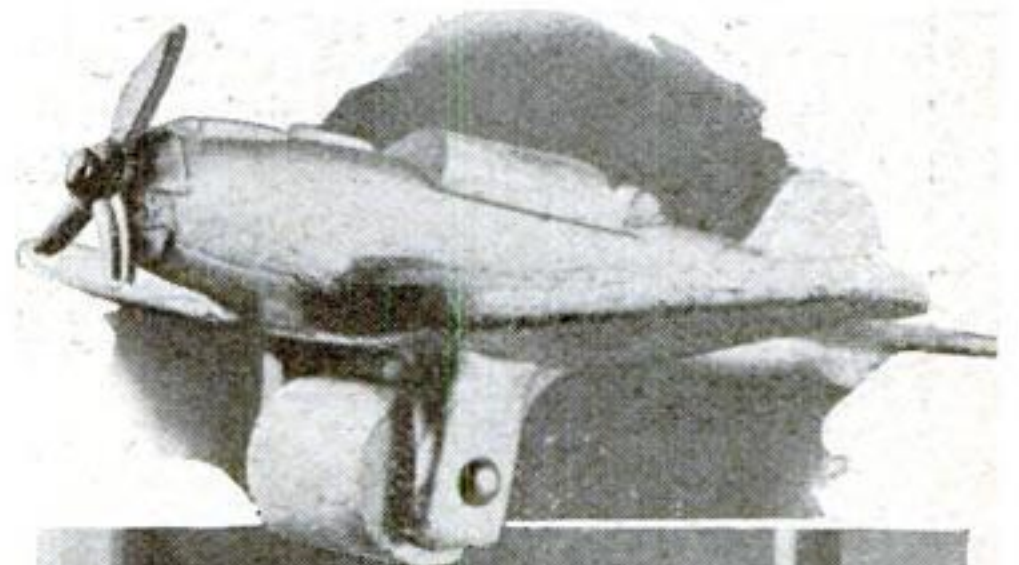
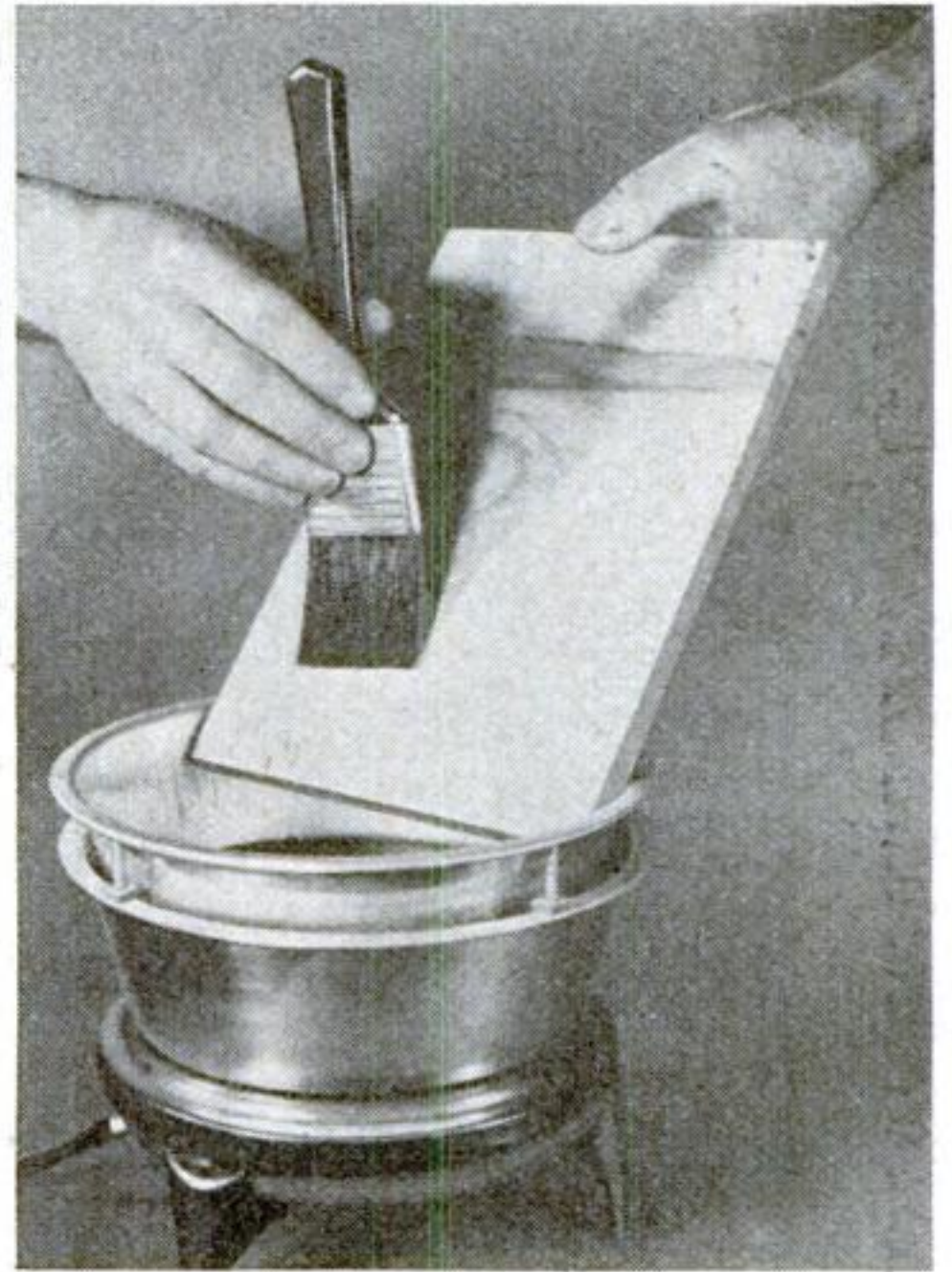
The glue compound for adhesive tape and similar purposes is made much the same, except that you may add some sugar or molasses, and possibly more water, to increase the tackiness. This must be determined by experiment because of the variation in the qualities of different glues. The cool mixture should be sufficiently adhesive to stick to any surface and yet have enough body so that it can be removed without leaving a mark.

A different type of compound is required for making printing rollers, as toughness rather than adhesiveness is desired. Simply melt the dry glue with sufficient molasses to form a composition of the necessary consistency.

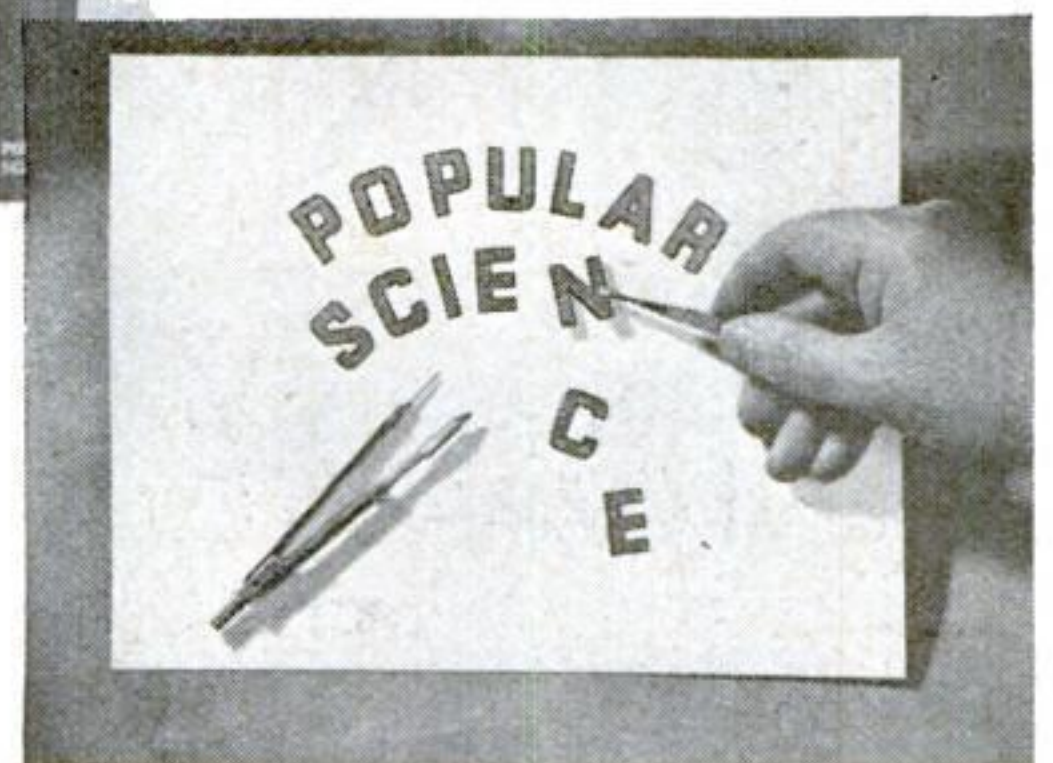


Tape, if treated on both sides, will prevent ink-stands, clocks, and other articles from moving on a smooth surface. At right, glue-painted letters may easily be removed and used a number of times

Below, simple type of hectograph made by coating a smooth board with the mixture, which is melted in a pan over hot water

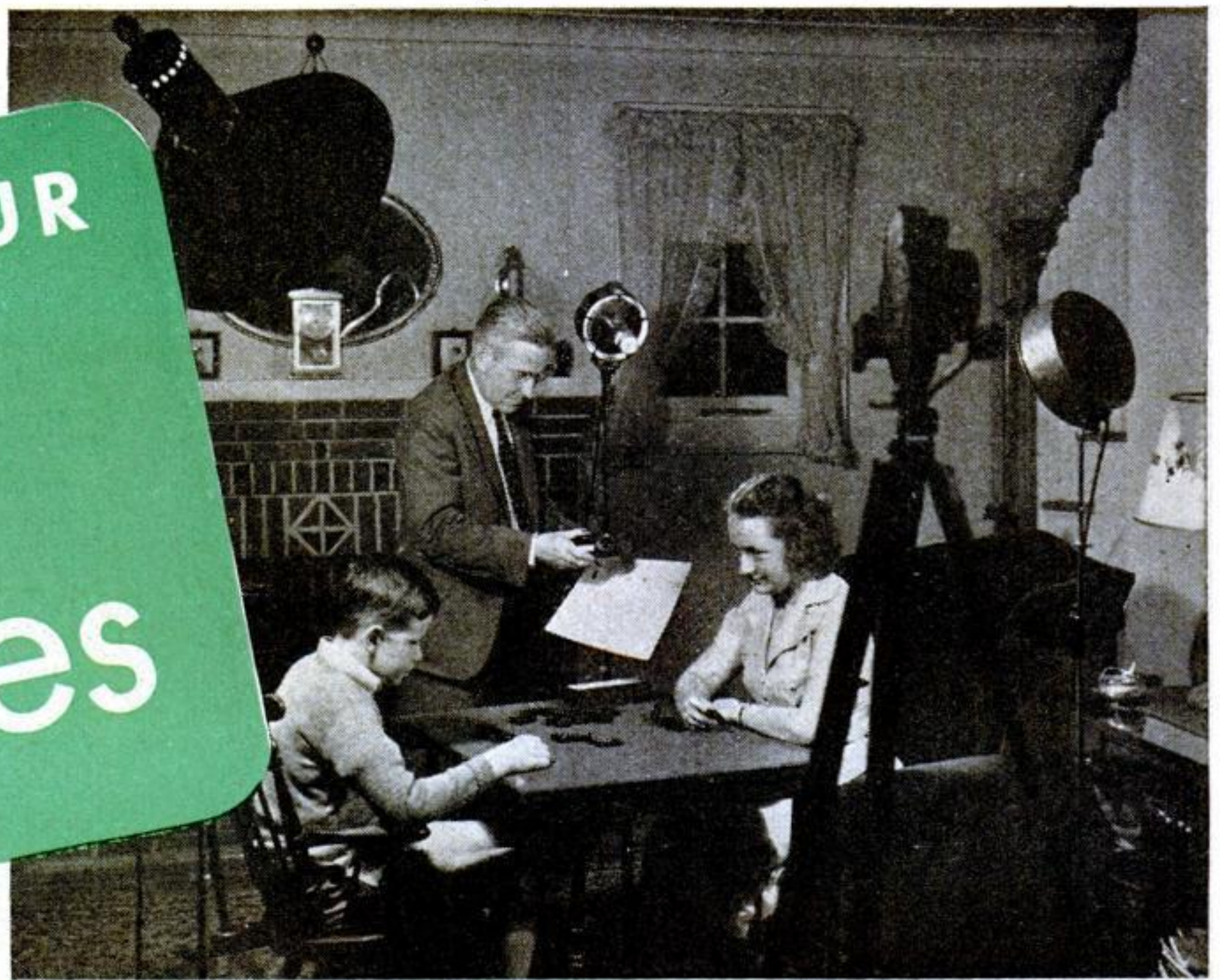


Substitute a glue-coated dowel for the wheels of a toy airplane and it will slowly travel down the window. Other lightweight toys may be used



IMPROVING YOUR Color Movies

By
FREDERICK D. RYDER, JR.



To get a reading for color movies with a photo-electric exposure meter, hold a medium gray card in the center of the scene where light strikes it squarely

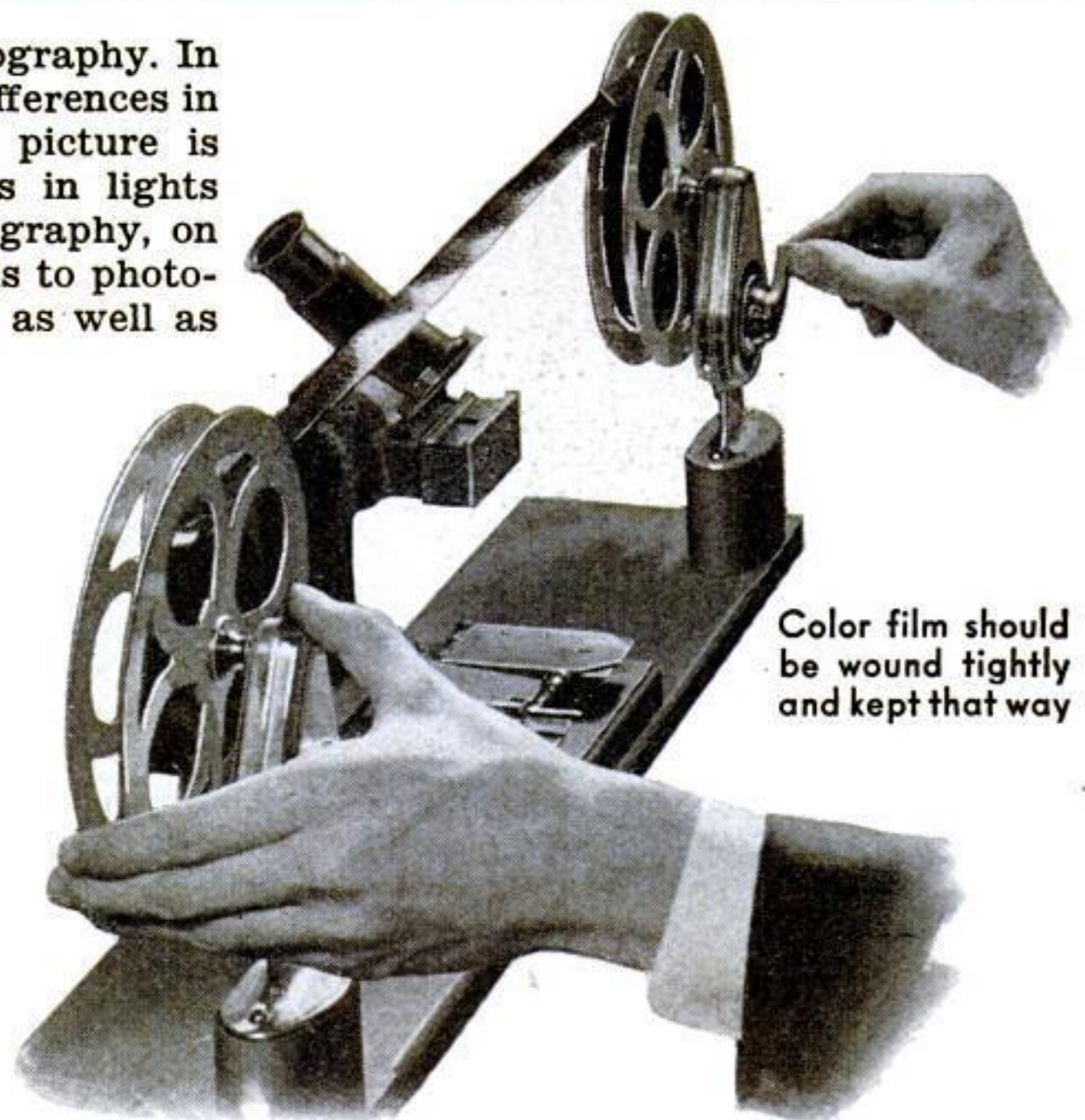
BECAUSE color movie film is relatively expensive, it is of great importance that you get the best possible results out of every foot of it, both in filming your subjects and in titling and editing the finished rolls.

Today it is universally agreed that the most accurate way to estimate the correct exposure is to measure the light strength with an exposure meter of the photo-electric type. As the cost of such a meter roughly equals the price of only three 100-ft. rolls of color film in the 16-mm. size, and you can easily spoil a good part of that much film on a single trip through inaccurate exposure, it is obvious that the purchase of a meter will soon pay for itself.

Even when you use a meter, you must get firmly fixed in your head the vital difference between all black-and-white

photography and color photography. In the first you are recording differences in light intensity because the picture is produced by these contrasts in lights and shadows. In color photography, on the other hand, your object is to photograph the color of the light as well as its intensity.

The ordinary method of using a photo-electric exposure meter for black-and-white work does not therefore work out so well when applied to color movie making. If there are too many bright objects in the picture, the reading will be too high; if but few, the reading will be too low. Instead of reading from the whole scene, hold a piece of matt-surface medium gray card in
(Continued on page 124)



Color film should be wound tightly and kept that way



Titles made on positive stock can be tinted by placing in a dye solution. Wedge end under cork, then roll bottle

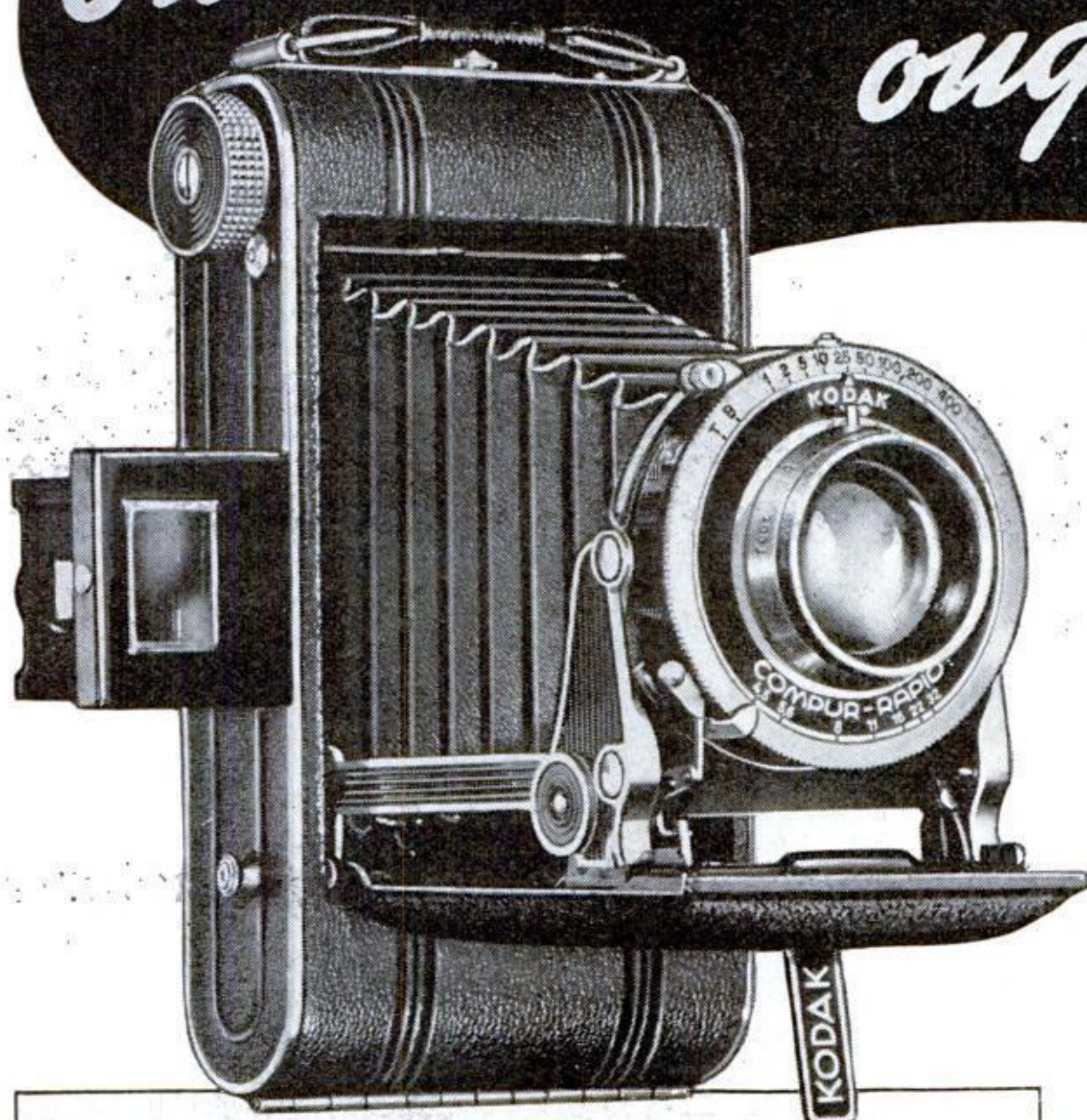


Extremely contrasty lighting, which is poor for black and white, is much worse for color



Flat lighting with very little shadow effect is necessary in order to get lifelike tones

Just what a modern camera ought to be



LENS—The new, fast, precise Kodak Anastigmat Special *f*.4.5.

SHUTTER—Compur-Rapid, 9 speeds to 1/400 second.

For other lens and shutter combinations for Kodak Specials, see listings at right



KODAK SPECIAL SIX-20—a long step forward in compactness, completeness of equipment, ease of handling, picture-taking ability

THE new Kodak Special anticipates tomorrow in every feature that makes for superlatively fine pictures taken with minimum effort.

Your lens may be the new, fast, precise Kodak Anastigmat Special *f*.4.5; shutter, a Compur-Rapid. Advanced refinements include new folding eye-level finder, new body shutter release, new one-finger bed release for quick closing. Case and back of special-quality aluminum; covering, pin-seal grain leather.

KODAK SPECIAL SIX-20, for pictures 2¼x3¼ inches: with Kodak Anastigmat Special *f*.4.5 lens, 1/400 Compur-Rapid shutter, \$45; with Kodak Anastigmat Special *f*.4.5 lens, 1/200 Kodamatic shutter, \$37.50; with Kodak Anastigmat *f*.4.5 lens, 1/200 Kodamatic shutter, \$33.

KODAK SPECIAL SIX-16, for pictures 2½x4¼ inches: with Kodak Anastigmat Special *f*.4.5 lens, 1/400 Compur-Rapid shutter, \$48.50; with Kodak Anastigmat Special *f*.4.5 lens, 1/200 Kodamatic shutter, \$41; with Kodak Anastigmat *f*.4.5 lens, 1/200 Kodamatic shutter, \$36.50. See them at your dealer's . . . Eastman Kodak Company, Rochester, N. Y.

(A) Ingenious new body shutter release. You hold the camera firmly in both hands, sight through the optical direct-view eye-level finder, and release the shutter with a light touch of the finger. Camera movement is minimized; you get the picture from eye level at the instant it's "right." Regular exposure trigger is retained.

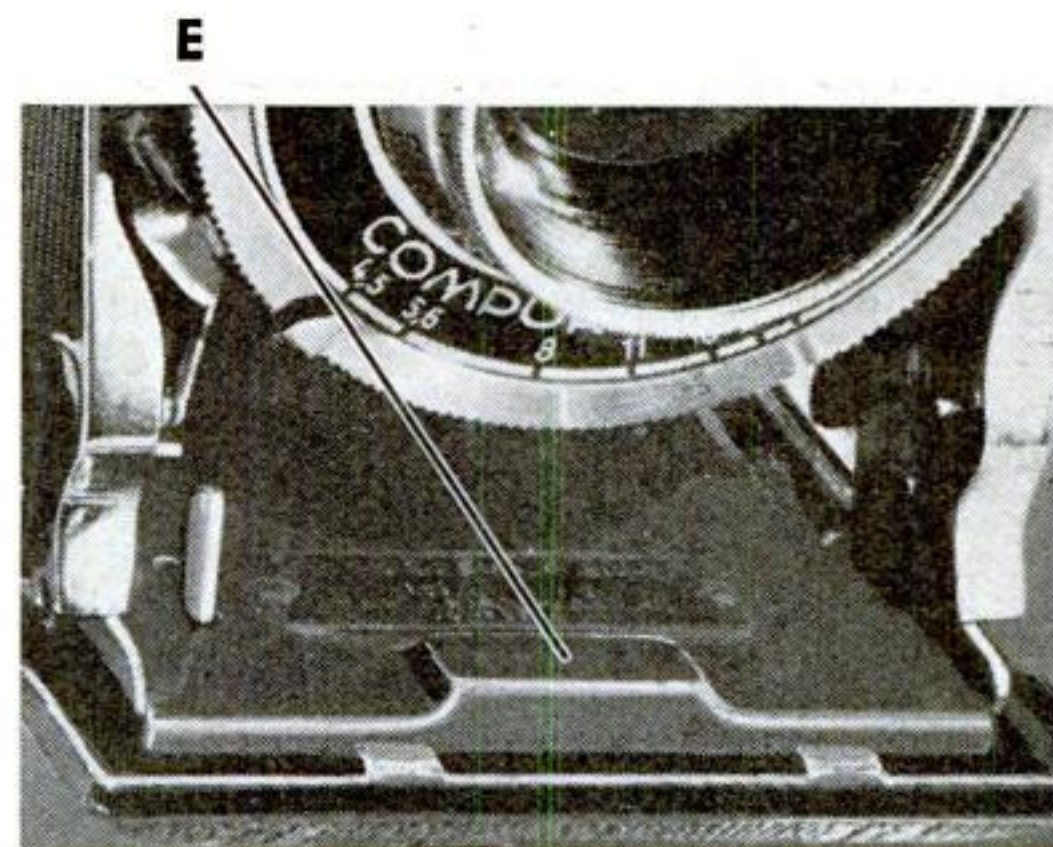
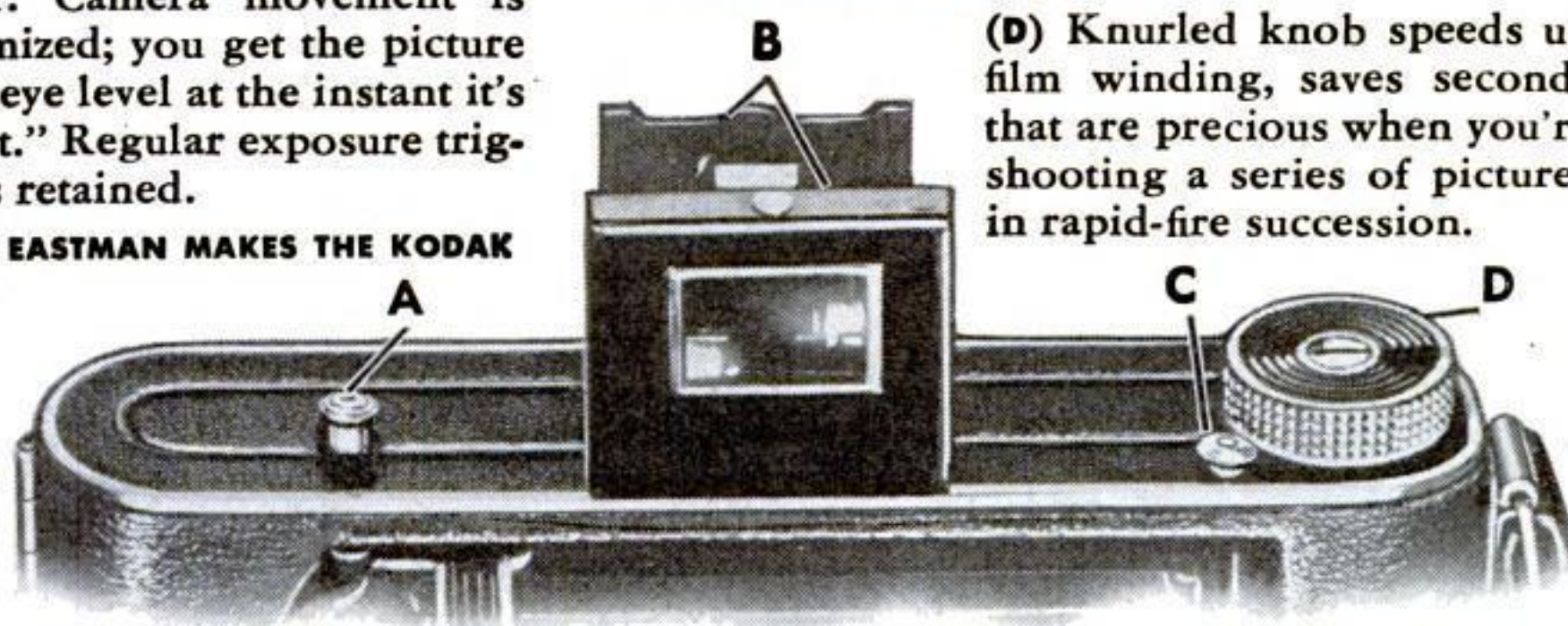
ONLY EASTMAN MAKES THE KODAK

(B) Optical direct-view eye-level finder; opens with a quick flip of the finger; folds flat to camera body when not in use.

(C) Press this button, and the camera pops open. Pull down the bed, and the lens snaps out into correct picture-taking position.

(D) Knurled knob speeds up film winding, saves seconds that are precious when you're shooting a series of pictures in rapid-fire succession.

(E) The convenient one-finger bed release, another new camera feature, which allows the camera to be closed in one quick and easy operation.

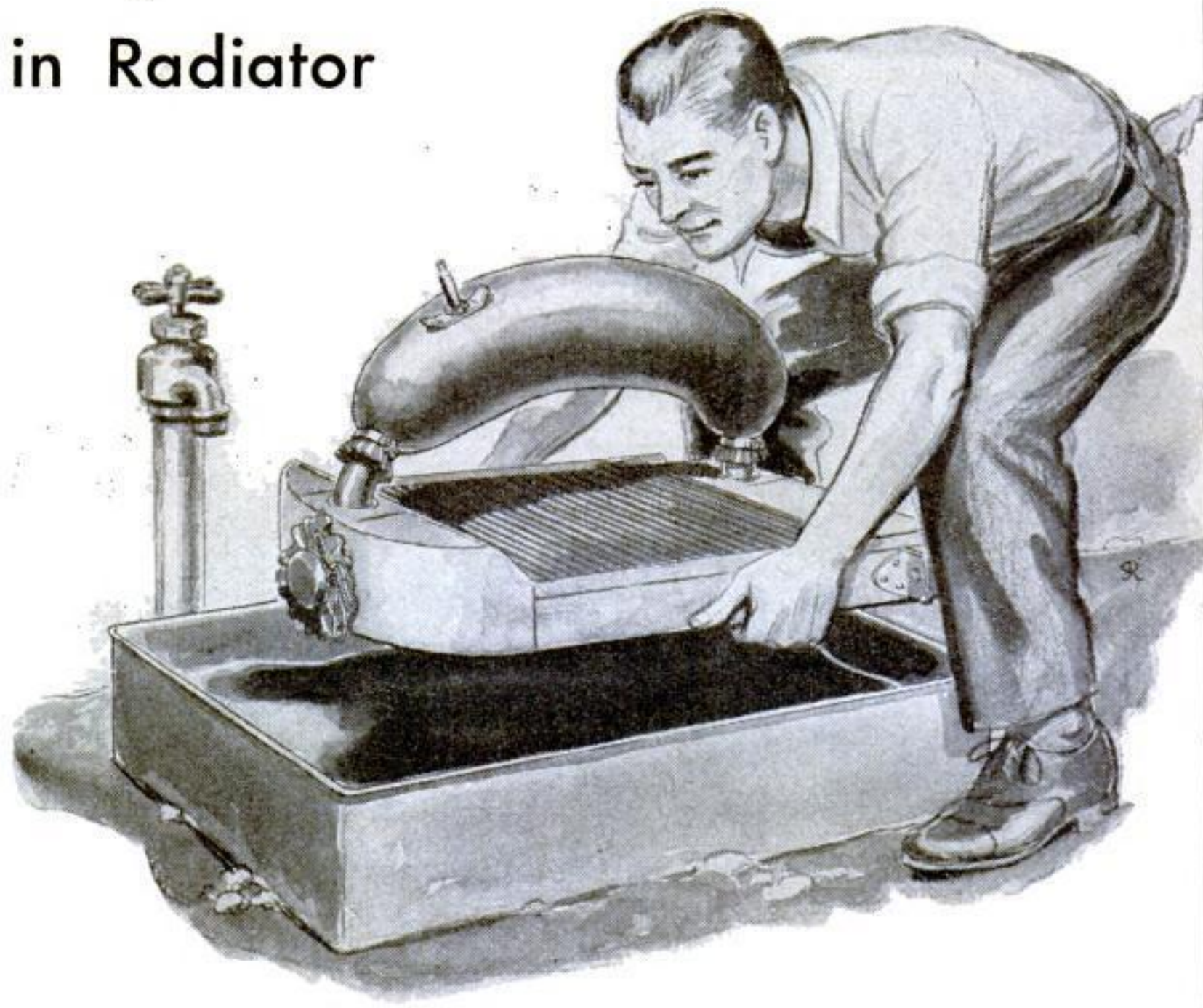


New KODAK SPECIAL SIX-20

Tricks To Help Motorists

Inner Tube Helps Find Leak in Radiator

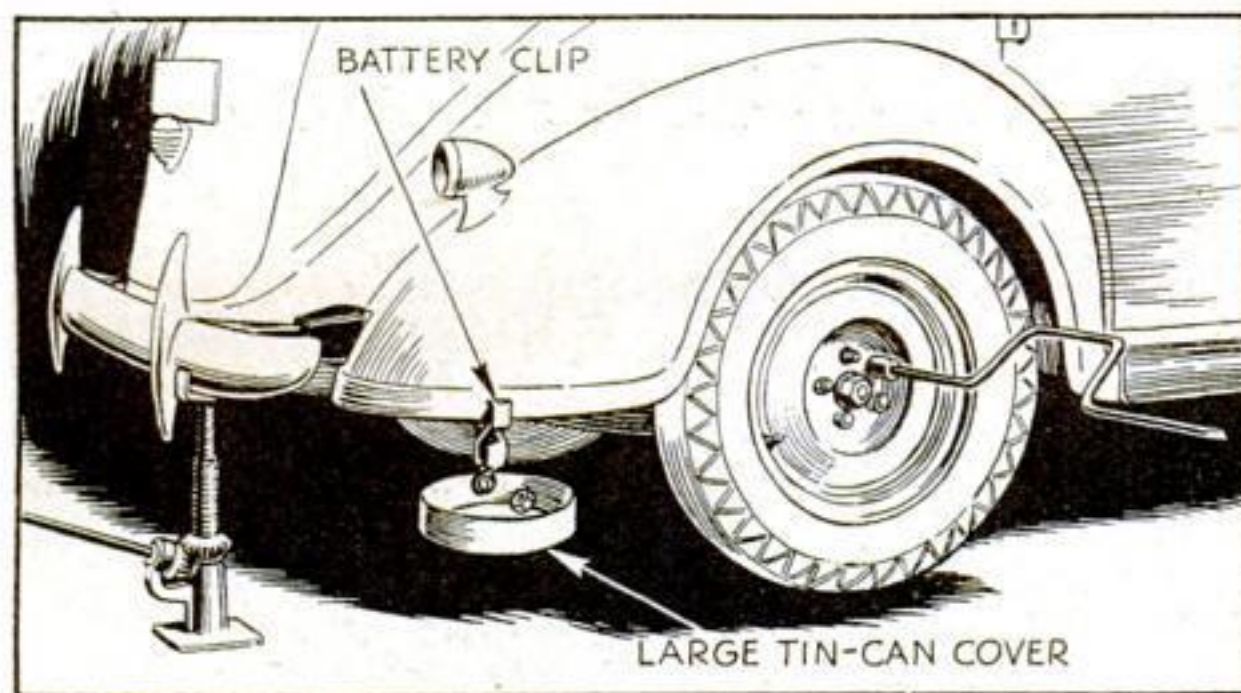
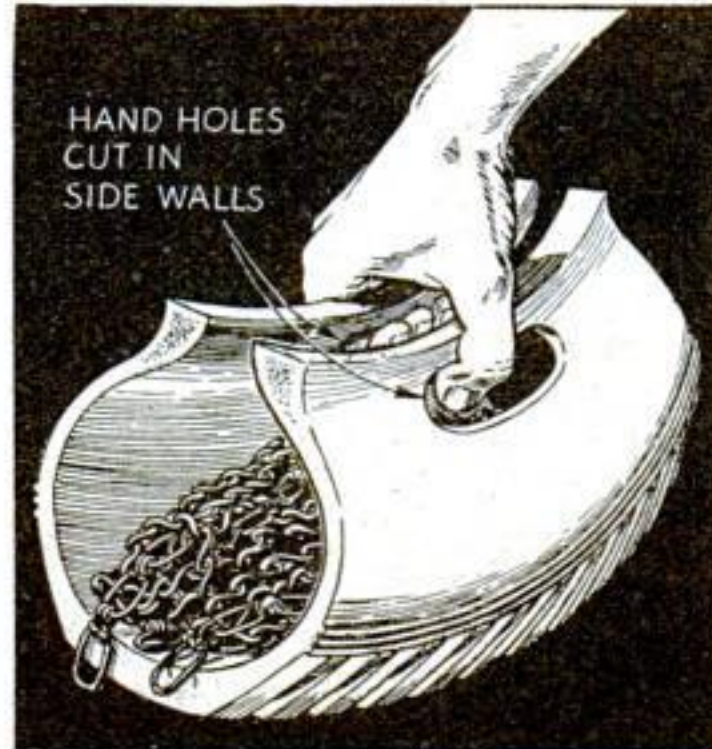
RADIATOR leaks can be located easily by fastening a piece of an old inner tube, including the valve, to the openings of the radiator with hose clamps, as shown at the right. Cover the filler opening with a square rubber patch, and plug the overflow pipe with a small cork. When air is applied to the tube, and the radiator is immersed in water, bubbles will show the location of the leak so it can be repaired.—J. P.



With all openings sealed and air pumped in through the tire valve, the radiator is placed under water. Bubbles will betray the position of leaks

Chain Carrier Made From Tire

A CONVENIENT carrier for tire chains can be made from a discarded balloon tire. Cut a section about eighteen inches long, and make hand holds under the beads on each side. The curved shape of the carrier prevents the chains from falling out.—H. A.

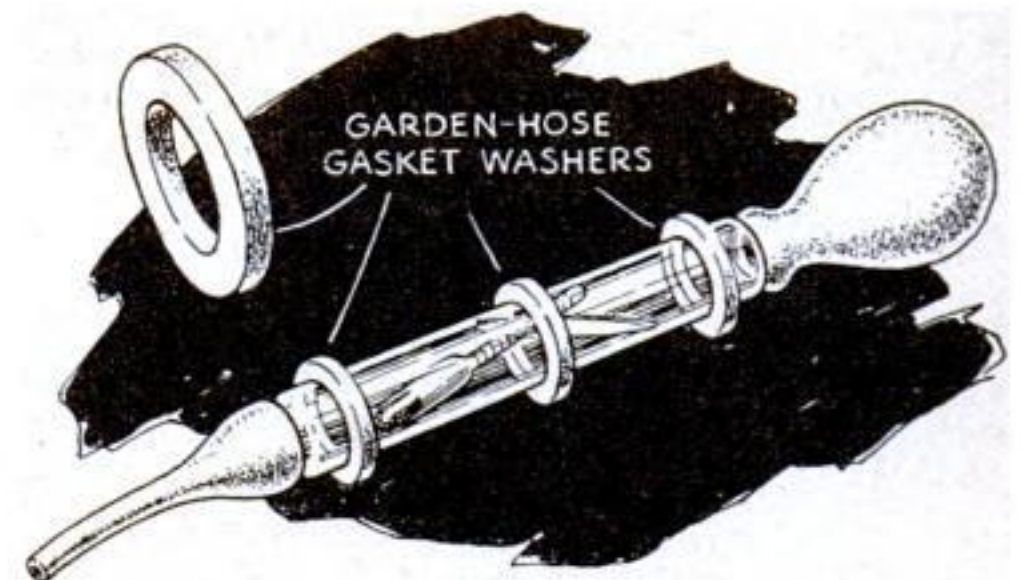


Handy Rack Holds Wheel Nuts When Changing Auto Tire

MY CAR, like many other late models, has no wide running boards on which to put the wheel nuts when changing a tire, so I use the little rack shown. It is made from a tin-can cover bolted to a battery clip whose jaws are lined with rubber, and fastens to the edge of the fender.—E. T. G.

Rubber Washers Protect Hydrometer

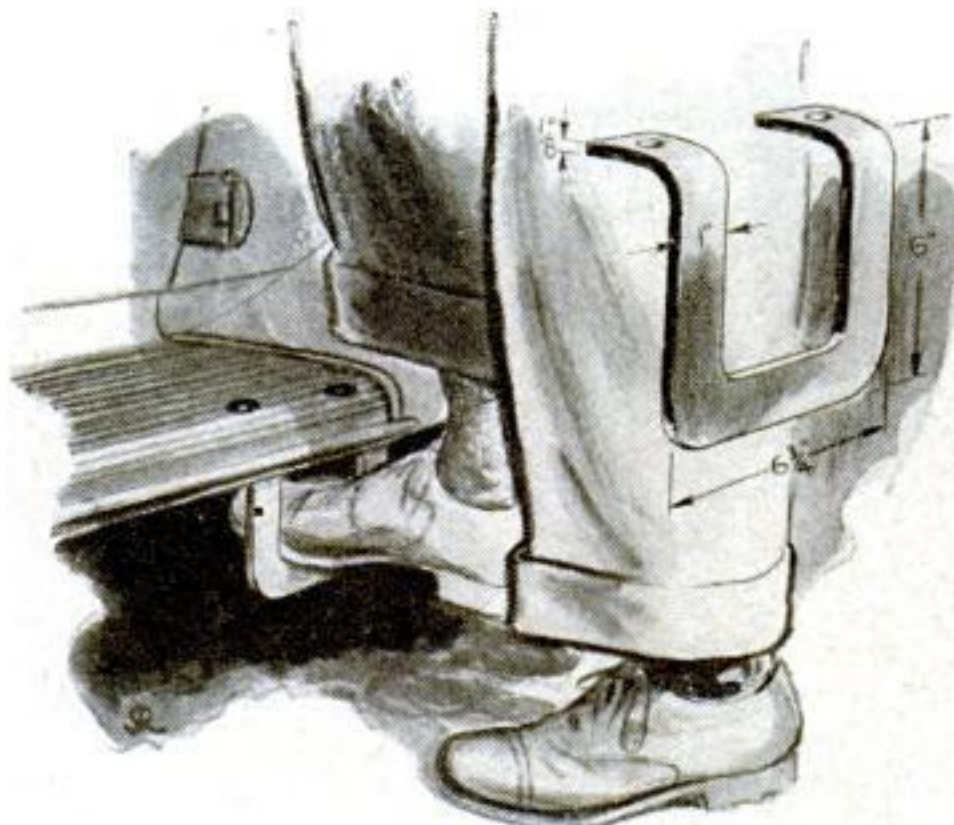
AFTER I broke a battery hydrometer and spilled acid over the floor of my car, I decided to find a way of protecting the glass tube. Inexpensive rubber washers of the kind used as gaskets on garden hose proved to be the answer. Three or four of them placed on the hydrometer barrel do the trick, and they do not interfere with the use of the instrument in any way. Dipping the washers in water makes them slip on easily. If the hose washers are not available, wind narrow strips of inner-tube rubber around the hydrometer, cementing them in place.—A. H. W.



Accidental breakage of a hydrometer is prevented by a few rubber hose washers

Shoe Scraper Keeps Mud Out of Car

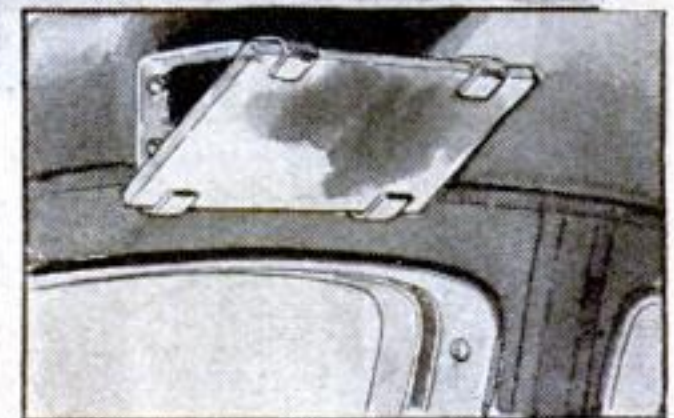
AUTOMOBILE owners who drive in muddy districts will appreciate this simple shoe scraper. It consists of sheet steel, one-eighth inch or more in thickness, cut in the shape of a "U," and bent as shown. Two holes drilled in the bent-over ends permit it to be attached to the running board of the car with nuts and bolts. Lock washers should be fitted to keep it from loosening. The scraper is inconspicuous, and does not interfere with the car's operation. It aids in keeping the inside of the car clean.—E. F.



Suggested dimensions for the foot scraper. It keeps mud from being tracked into a car



Dotted lines show how the mirror permits the driver to see the curb. The mirror is held by two homemade brackets



Mirror Aids in Parking at Curb

AN EXTRA mirror, placed as shown, will enable you to park close to the curb without danger of scraping the fenders or running board. It is mounted inside the car above the front window by means of two light metal brackets. The exact position and angle of the mirror will depend upon the width of the car and the stature of the driver. It should be placed so the running board and curb both are visible from the driver's seat, thus enabling the driver to gauge the distance from the curb.—W. H.



SPEAKING of tool work, the cost of machining square holes is enough to give anyone a headache. In many cases the most economical way is to cut open slots in two pieces and then resort to welding.

Large, serviceable plug gauges can be made from seamless steel tubing with aluminum cores. The material need not be hardened for on-and-off use. Grind the tools cylindrically 0.002 in. undersize; then chromium plate to size.

When the bores of milling machines or drill presses are none too good, relieve the shanks of drills and reamers in the center to avoid all chance of play.

It may cost a few cents more to make counterbores with interchangeable pilots, but the tools will last four times longer. It also enables the end teeth to be sharpened much more easily.

I know of a shop where an expensive overhead drum used for a traversing belt was replaced, when the machine itself could have been motorized at half the cost.

A section of discarded power hack-saw blade, fitted to a slotted holder, forms a good cut-off tool for lathe work.

If you make it a habit to chamfer the edge of a bore before starting a reamer, you will be well repaid for that extra minute by the accuracy of the result.

For cutting threads, especially of the Acme type, it is a good idea to have two identical tools. If one becomes dull or breaks and is fitted to a stop, it can quickly be replaced by the other without interfering with the set-up.

Today's precision requirements in respect to bores would seem to demand some changes in the taper of mandrels. It makes sense to have half the length ground straight, and the back end tapered from 0.0003 to 0.0005 per inch, depending on the nature of the work.

Of course a concaved radius can be formed with an end mill or cutter ground accordingly, but for low cost a grinding wheel with a convex radius has all other procedures thoroughly beaten.

To lap bronze bearings in position, grind a cast-iron lap 0.001 in. over the spindle diameter and flow fine lapping compound mixed with water through the oil holes. Oscillate the lap gradually until it is making complete turns, and take up the bearings as required.

The cheapest way to make collars for gang arbors is to use seamless steel tubing. It is available either in tool or machinery steel form.

CHAMPIONS IN MIDGET RACING

FAST GET-AWAY DEPENDS ON SPARK PLUGS

**YOU CAN
DEPEND ON
CHAMPIONS**



The snap and speed of a fast get-away, demanded by modern motorists, depends to an extraordinary degree on spark plugs. The masters of fast get-away, the midget car race drivers of the country, almost to a man use Champion Spark Plugs exclusively.

Remember, too, that a highly responsive engine, one that develops full power and speed, is doubly desirable because it is at the same

time the most efficient and economical engine you can drive. And since spark plugs are of such vital importance in engine performance, it will pay you to insist on those which make every engine a better performing engine—Champions. Fourteen consecutive years of supremacy in racing have established Champion's position in this respect. Demand Champion Spark Plugs—because you can depend on them.

CHECK AND CLEAN SPARK PLUGS WHEN YOU CHANGE OIL

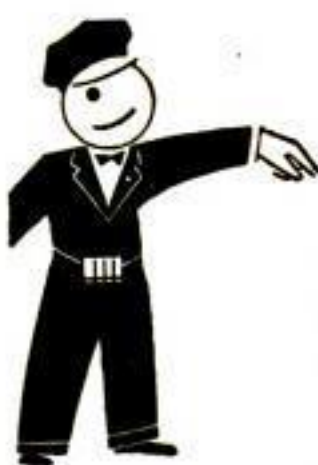


Pouring Pyroil Into Gas Tanks of Tri-Motored Plane, United Air Transport, Ltd., Edmonton, Alberta.

Newest of airlines to use Pyroil is United Air Transport, Ltd., inaugurating, July 5, 1937, the first Air Mail-Passenger service from Edmonton, Alberta to the Yukon.

Aviation Pyroil, like Pyroil for your car, safeguards! Gives greater staying power to regular lubricants. Protects valves, bearings, pistons—every moving part—against undue damage and wear, especially under conditions of severe operation.

Pyroil increases power, too. Increases mileage. Offsets repairs. Saves its cost many times over. Sold everywhere. Manufactured and Guaranteed by Pyroil Company, W. V. Kidder, Founder, 462 LaFollette Ave., LaCrosse, Wisconsin, U.S.A.



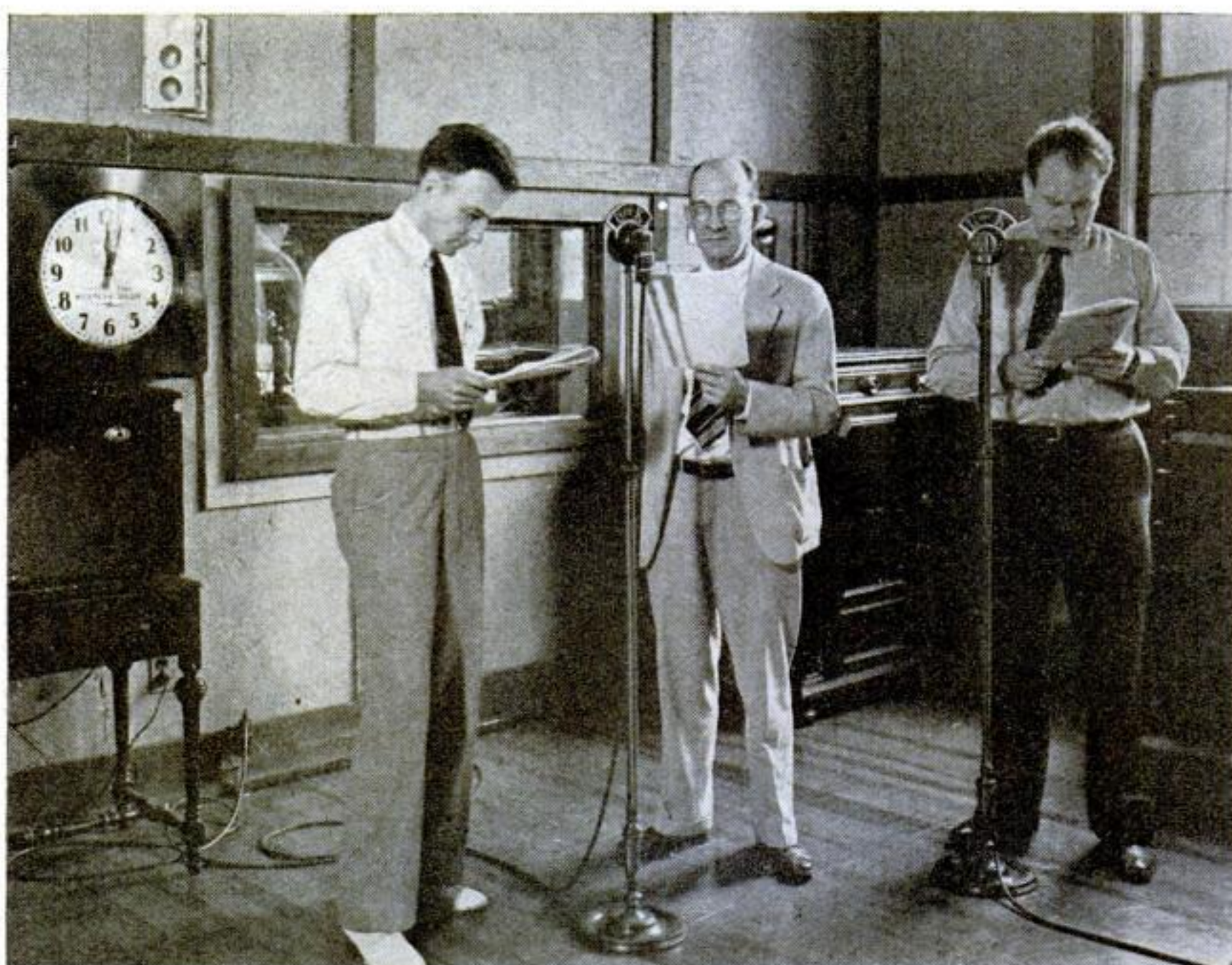
Pyroil covers every frictional surface of your car with an "extra oiliness" film—different from and greater than the regular lubricants you buy. When regular lubricants thin out or break down, Pyroil still stands guard against damage to vital parts! Likewise, when your engine overheats, when sludges, gums and carbons accumulate, Pyroil offsets corrosive damage, too, (metal wear). Corrosion cannot attack your car when you use Pyroil!

FREE BOOKLET: Write for your free copy of Pyroil's exciting new Booklet, "My Greatest Thrill on the Speedway." Exclusive stories by world famous auto racing pilots. Mail Coupon!



PYROIL COMPANY
462 LaFollette Ave., LaCrosse, Wisconsin, U. S. A.
Please send me a copy of your Free Booklet, "My Greatest Thrill on the Speedway." Also interesting and important Pyroil facts.

Name.....
Address.....
City.....State.....



Home workshop broadcasts will be made from this studio at the University of Kentucky. Left to right, David M. Young, secretary of the Lexington Homecrafters, L. S. O'Bannon, president, and E. G. Sulzer, studio director

Lexington Homecrafters to Broadcast

HOMEWORKSHOP GUILD CLUBS START SEASON'S ACTIVITIES

SIX radio talks of interest to home workshop fans will be given this fall by members of the *Lexington (Ky.)* Homecrafters over Station WHAS, Louisville, through the remote-control studios of the University of Kentucky at Lexington.

The schedule is as follows: Sept. 17, "Equipping the Small Workshop" by E. B. Morgan; Sept. 24, "Restoration and Reproduction of Antique Furniture" by Dr. Harry G. Herring; Oct. 1, "Toy Projects for the Home Workshop" by Judge O. C. Boone; Oct. 8, "The Homecraftsman Builds a Summer Camp" by J. C. Warren; Oct. 15, "Profit from Home Workshop Activities" by Prof. Lester S. O'Bannon; Oct. 22, "Odd Jobs of Home Maintenance and Repair for the Homecraftsman" by David M. Young.

All talks will be given from 1:30 to 1:45 p.m. (CST), the regular period for educational talks on the University's daily program through that station.

The establishment of junior auxiliaries to the National Homeworkshop Guild was discussed by industrial arts students and teachers at the annual "open house" of The Stout Institute, *Menomonee, Wisc.* Clyde A. Bowman, dean of the School of Industrial Education and a member of the advisory council of the Guild, presided and LeVern T. Ryder, former president of the Guild, answered questions.

Mr. Ryder also gave talks on "Archery, Past and Present," "Hobby Germs in Industrial Arts," and "Hobbies for Girls." More than 3,500 visitors attended the sessions.

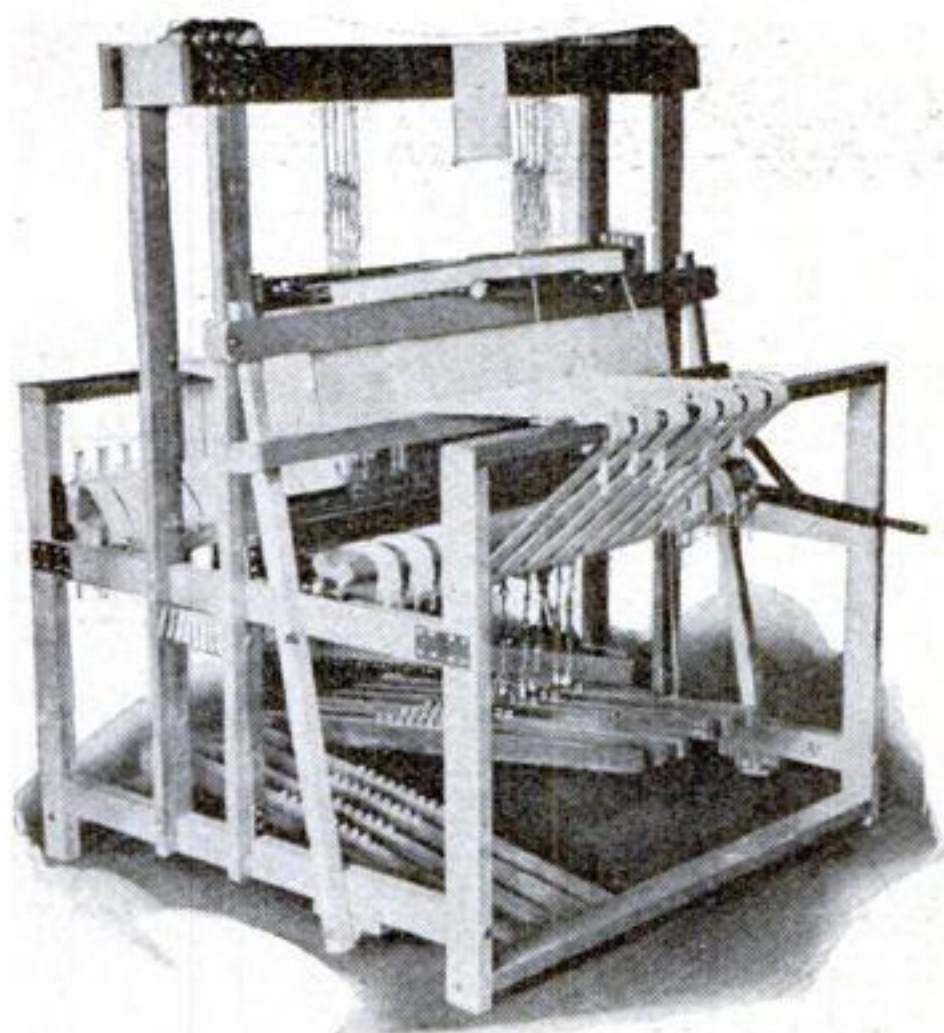
New officers of the Sunset Social and Hobby Club of *Brooklyn, N.Y.*, are Charles Ward, president; Bennie Amodeo, secretary; William Mordhurst, treasurer. Meetings were held throughout the summer, but activities were curtailed . . . Two members of the *Redlands (Calif.)* Homeworkshop Club



This window exhibition of the Edison Homeworkshop Club, Chicago, gathered large crowds

built an ingenious model of an ocean liner for a local Sunday School to indicate the progress of each class . . . Moving pictures borrowed from the Museum of Natural History in New York were shown at a recent meeting of the Fort Stanwix Hobby Club of Rome, N.Y. A club library has been established. Activities will be resumed in the fall with a banquet.

P. F. Hirsch, secretary of the Newcastle (Calif.) Homeworkshop Club, won fourth place in the grand prize division of the '49 Celebration and Twentieth District State Agricultural Fair at Auburn. His float consisted of a replica of the first Central Pacific R. R. locomotive. The engine and tender were about 16 ft. long and were mounted on a truck. In the flower show section, Mr. Hirsch won third prize for roses contained in a black vase with book ends of horses mounted on a mahogany base,



A 36-in. loom with eight harnesses built by R. E. Jess, of the Corn Huskers Homeworkshop Guild, Springfield, Ill. Jess made everything but the heddles and reed

and fifth prize for a model coach decorated with flowers. The club recently had an exhibition in an Auburn department store and then moved it to the Newcastle Post Office for an additional two-weeks display.

Concluding a year crammed with all types of activities, the Denver (Colo.) Homeworkshop Club held an exhibition in the Y.M.C.A. and on the final night celebrated with a banquet at which twelve members of the Cheyenne (Wyo.) Homeworkshop Club were guests. Capt. George Dyon presented D. R. Kinports, president of the visiting club, with a beautiful model of the historic square-rigger *Bounty*. Place cards consisted of small silhouettes cut from aluminum and mounted on wooden bases. At a recent meeting metal spinning and hammered work were demonstrated; then the members worked on projects under expert supervision. Clever postcard notices and advertisements in newspapers help to bring the members out.

The visit of the Homecraft and Modelmakers' Guild of Richmond, Va., to the Capital Homecraft Club, Washington, D.C., was so successful that a second meeting, at which the Richmond club will play host, is scheduled for the near future.

"How to get better publicity" is the topic for clubs to discuss at September meetings. A special bulletin containing many helpful suggestions has been sent to club secretaries.



3 STAGES IN PIPE-SMOKERS' LIVES WHEN P. A. HITS THE SPOT!

Roll-your-owners, too, enjoy P. A.

I WAS DISAPPOINTED IN MY FIRST PIPE. THEN I DISCOVERED PRINCE ALBERT, THE **NO-BITE TOBACCO**. IT'S SO **MILD!**

I DIDN'T START WITH PRINCE ALBERT, AND I SOON BEGAN TO NEGLECT MY PIPE. NOW IT'S ON STEADY DUTY, THANKS TO THE **COOL SMOOTHNESS** OF P.A.'S CRIMP CUT!

AS A REGULAR PIPE-SMOKER, I WANTED **TASTIER BODY** IN MY TOBACCO. P.A. SUPPLIES IT. **FREE FROM HARSHNESS!**

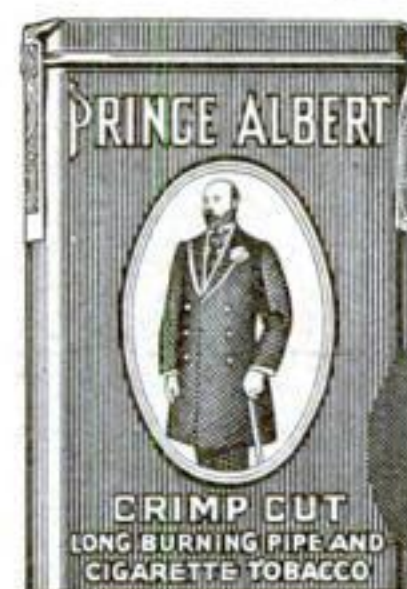
NEW PIPE JOY GUARANTEED!

Smoke 20 fragrant pipefuls of Prince Albert. If you don't find it the mellowest, tastiest pipe tobacco you ever smoked, return the pocket tin with the rest of the tobacco in it to us at any time within a month from this date, and we will refund full purchase price, plus postage.

(Signed) R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

PRINCE ALBERT

THE NATIONAL JOY SMOKE



50 pipefuls of fragrant tobacco in every 2-oz. tin of Prince Albert

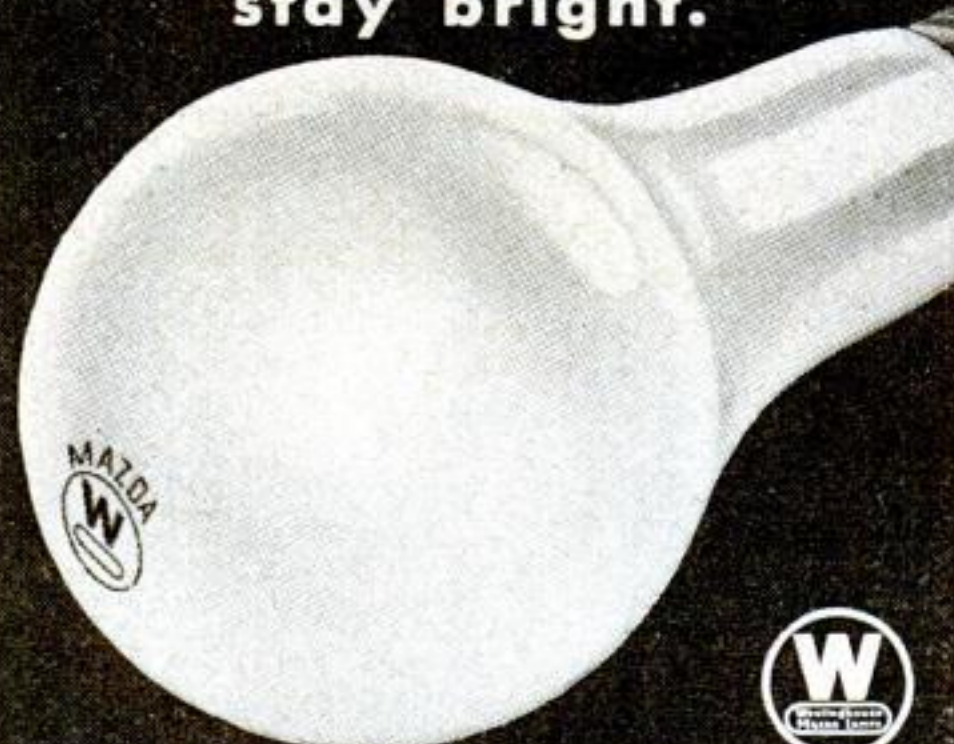
THE **2 OUNCE** BIG RED TIN
SO MILD!



eyes right!

AND KEEP THEM RIGHT WITH PROPER LIGHT

Be sure of better light
by using Westinghouse
Mazda Lamps. They
stay bright.



Mazda Lamps
MADE BY
Westinghouse
*The name that means
everything in electricity*

Novel Sundial Rivals Clock

(Continued from page 91)

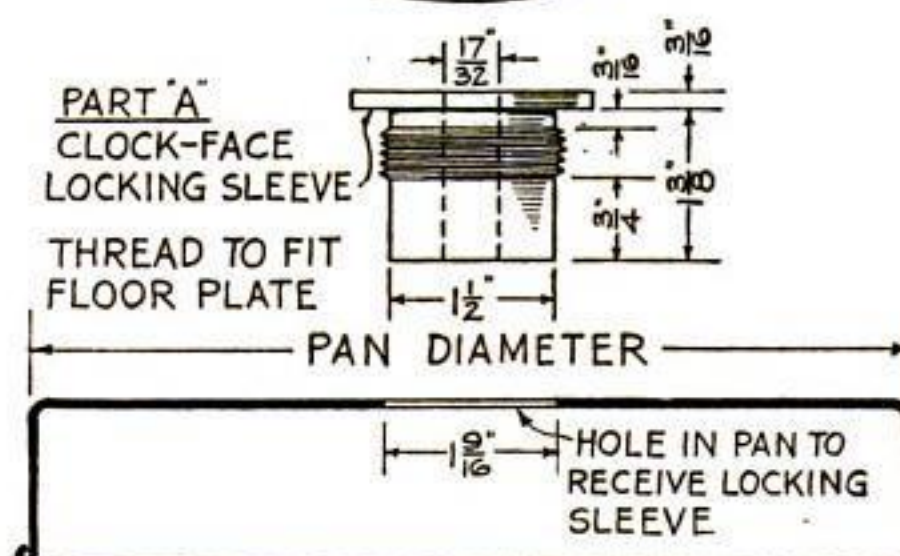
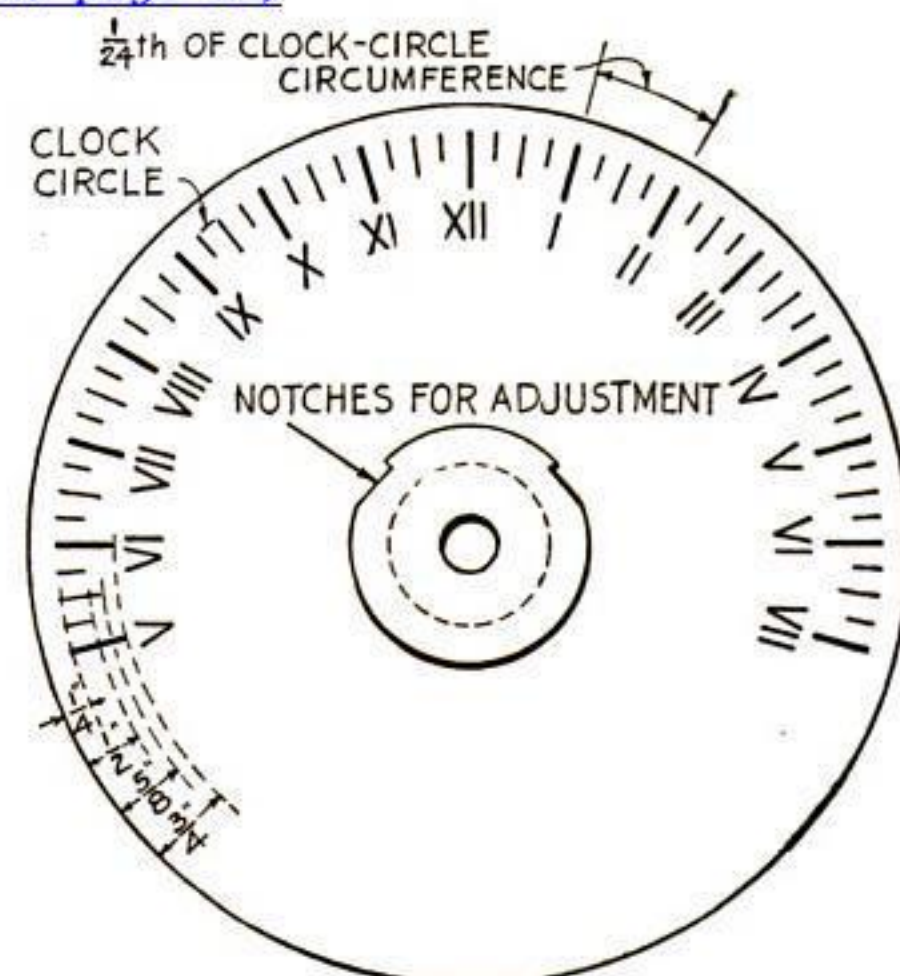
of the shadow-caster should be just 7 in. directly in front of the intersection of the axes of the analemma. The details of the shadow-caster assembly may, of course, be varied to suit the individual. The writer used a length of $\frac{3}{8}$ -in. iron rod and a piece of $\frac{3}{4}$ -in. strap iron.

To engrave the clock face, find the center of the aluminum cake pan by trial. The size of the pan makes no difference. Using this point as a center, lightly scratch a circle of $\frac{1}{2}$ -in. smaller diameter than the pan. Divide this circle with dividers into twenty-four equal parts. Each one of these units will represent one hour of time. Divide each unit into halves, quarters, and twelfths, which will give you five-minute intervals.

Using a well-sharpened, soft pencil, draw radial lines from the hour divisions. Select sharp chisels of three different widths, and mark the quarter hours as indicated. Use a center punch, if desired, to indicate the five-minute divisions. As you can read the sundial only from about 4:00 a. m. until 8:00 p. m., the clock face need be graduated only between these limits.

One of the interesting things about this sundial is that if you know the correct time and date, the sundial will indicate the true north direction. This feature is used to advantage in setting up the sundial, which must be placed so that the axis of the shadow-caster assembly points to the celestial north (North Star). Look on any map and determine your latitude (the number of degrees north of the equator). Cut a cardboard template to this angle, as illustrated, and adjust the turnbuckle until the carpenter's level is horizontal.

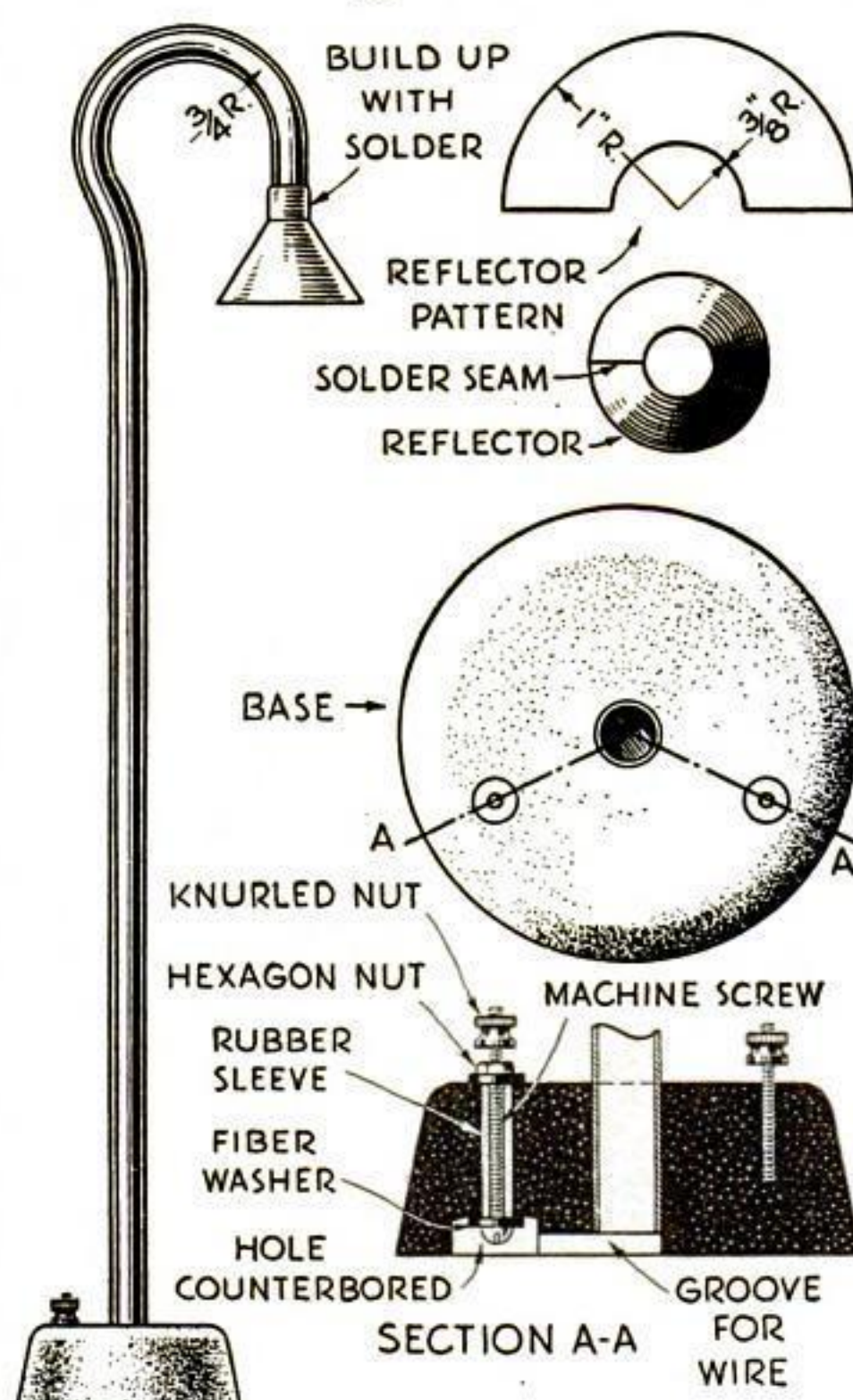
Put the shadow-caster assembly in place and orient the horizontal base until the axis of the hinge points about east and west. This need be only approximate, as the sundial will orient itself by trial. Now bring the shadow of



Chisels of different widths are used to mark the quarter hours on the cake pan

the point to the proper place on the analemma (the date) and adjust the clock face until the reading corresponds to the correct time, obtained from your watch. Lock the clock face in this position. At two- or three-hour intervals, compare the sundial reading with the correct standard time and make any final adjustments that are necessary to keep the shadow of the point at the proper place on the curve and the time-indicating pointer at the proper time on the clock face.

Making Street Lamps for Railway Layout



A STREET lamp for model-railway layouts may be made as shown from an 11-in. piece of $\frac{1}{4}$ -in. outside diameter copper oil pipe and a lead base cast in any convenient mold, such as the outside race from a roller bearing.

The reflector is cut from a tin can. The wire, socket, and bulb are from a string of Christmas-tree lights. Break the composition from the socket, remove and discard the wire attached to the shell, run the other wire through the pipe, and solder the shell to the pipe, and the reflector to the shell. The base terminals are arranged as shown, one being insulated from the lead.

On my layout all lights are wired in parallel and fed with current from a 6 to 12-volt transformer. Individual switches are used to cut out the lamps not wanted.—H. E. DENZLER, JR.

Red Lead and Cloth Stop Leaks in Water Pipe

For temporarily repairing a leaking pipe, I coat the pipe thickly with red lead, wrap on a layer of cloth soaked in the lead, and apply more lead and another layer of cloth. Several layers of lead and cloth, once the lead hardens, will prove satisfactory in all but the most stubborn cases.—MAURICE GORE.

Tent Stove for Camping

(Continued from page 93)

of the other end at right angles to form the handle. On the side of the doors opposite the hinges, drill a hole $1\frac{1}{4}$ in. from the edge and rivet these handle strips in place. Be sure to make a turning fit.

The doors should lap over the openings $\frac{1}{2}$ in. at top and bottom, $\frac{1}{4}$ in. at hinge edge, and $\frac{3}{4}$ in. at handle edge. Rivet the doors in place and mark the position of the handles on the stove. The catch for the fastener is made by folding a $1\frac{1}{2}$ by $1\frac{1}{2}$ -in. piece of scrap iron into a $\frac{1}{2}$ -in. strip and bending as indicated. Rivet the catch to the stove.

Cut and bend the toppiece so that the laps come on the outside of the stove. This is necessary for strength and good draft. Rivet the top.

The cover for the draft opening is simply a piece of sheet iron slightly



Hammering over tabs of stovepipe nipple

larger than the opening. When in use, it is held in place with a small stone or a handful of sand.

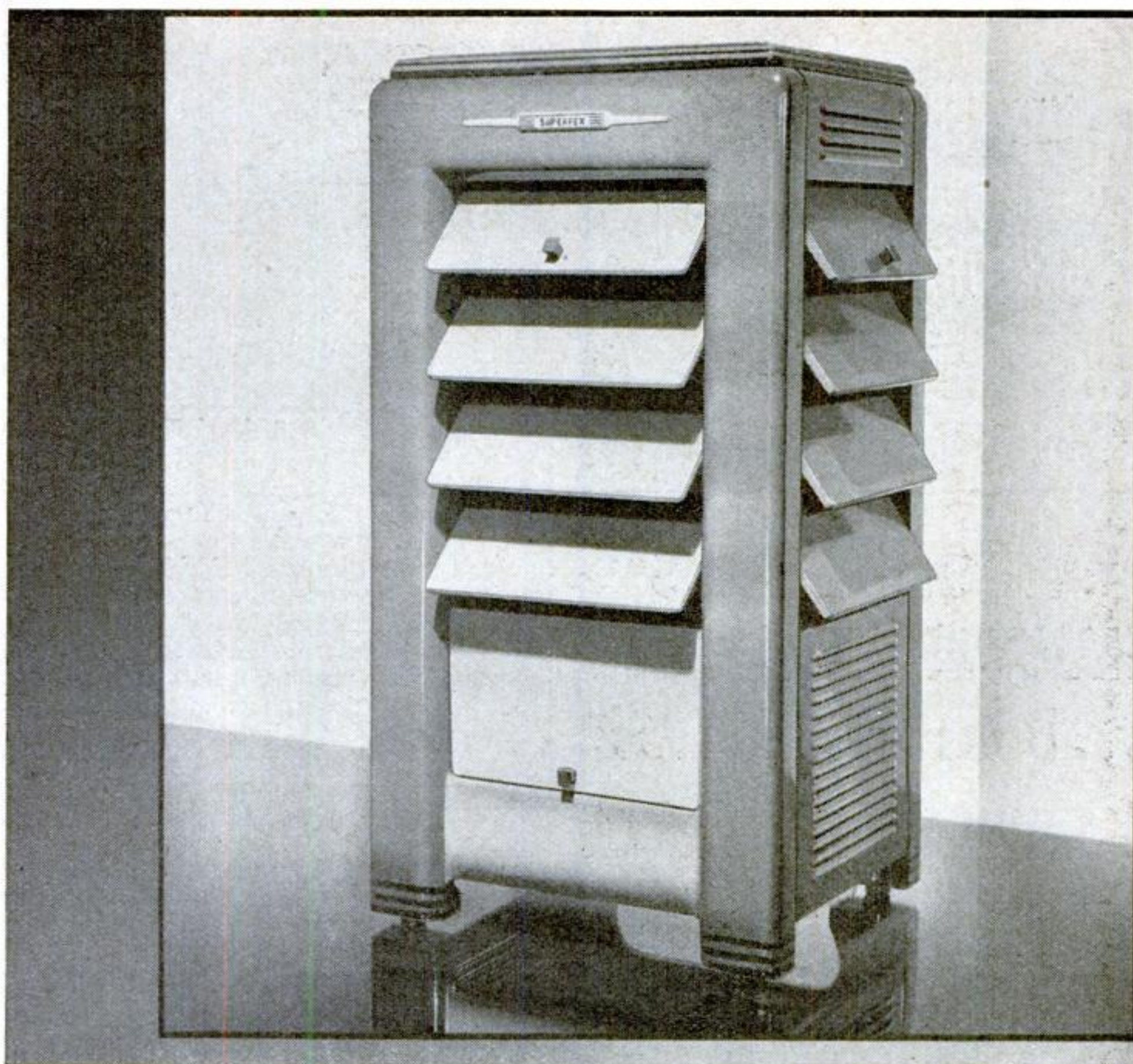
The grate may be purchased ready-made of stiff nickel-plated wire, or one can be made as shown.

Decide where to place the stove in the tent, then cut a hole in the canvas 3 in. smaller than the square of flashing metal to be inserted. Turn a $\frac{1}{4}$ -in. hem on the two sides and across the top of this opening. Continue the bottom cut a distance of $1\frac{1}{2}$ in. on each side of the opening to allow the full width of the metal to come out. Turn a $\frac{1}{4}$ -in. hem on this edge. Stitch a strip of canvas $1\frac{1}{2}$ in. wide around the opening at the sides and top on the inside of the tent. This strip is to form a sort of pocket to receive the flashing, so it must be sewed about $1\frac{1}{4}$ or $1\frac{1}{2}$ in. from the edges of the opening.

Cut the pipe hole in the center of the flashing sheet and, after inserting the sheet in the tent, rivet it through the tent proper, the metal, and the inner strip.

This stove works on the principle of a charcoal burner; that is, it has a very small supply of air and turns the wood to charcoal before burning it. Start the fire in a small way by taking a few chips and light sticks and reducing them to coals; then add larger sticks on top. When a good bed of live coals has been made, large billets can be put on and the fire shut up. The fire will burn slowly all night, giving off heat, and in the morning all you have to do is open it up and it is ready to fry your flapjacks and bacon.

If your tent has a sewed-in canvas floor, it will be necessary to build a bed for the stove with stones and sand.



Superfex Heat Director No. 1035

CHOOSE THE STOVE THAT DOES THESE 4 THINGS

1. Circulates warm air like a furnace.
2. Radiates heat you can feel, like a fireplace.
3. Directs heat downward to warm the floor.
4. Ends ashes and drudgery by burning oil.

There's no need to limit your comfort either to circulating or radiating heat. Enjoy both with a SUPERFEX HEAT-DIRECTOR —

The Mark of Quality



**SUPERFEX OIL BURNING
HEATERS**

PERFECTION STOVE COMPANY
7876-A Platt Avenue, Cleveland, O.

Please send me the booklet about SUPERFEX HEAT-DIRECTORS and RADIATING Heaters.

Name _____

St. or R. F. D. _____

Post Office _____

County _____

State _____



**RESETS
BATHROOM
FIXTURES**

WOOD IN CANS HANDLES LIKE PUTTY ...Dries to Real Wood

As it comes from the can or tube, Plastic Wood is soft and can readily be moulded with the hands, just like putty. When hard it has all the strength and properties of actual wood, except grain.

PLASTIC WOOD makes 1001 Repairs

It's needed in every shop, in every home, for resetting loose bathroom fixtures, repairing broken furniture, damaged wood, tool handles, correcting mistakes, modeling, etc. Plastic Wood will take and hold nails and screws firmly without splitting, can be planed, sawed, turned in a lathe, worked with any wood-working tools, and can be sanded to a hair edge. Adheres to wood, metal, glass or plaster.

Get it at Hardware,
Paint and 10¢ Stores

**PLASTIC
WOOD**



It Joins and Repairs



Also available
in Metal Ce-
ment in large
or small tubes.

Quickly, perma-
nently joins and
repairs china,
glass, wood,
celluloid, etc.—
Transparent,
yet sets like
granite!

Old English CEMENTS

BLUEPRINTS

for Making Models and Other Craftwork



WHEN building a ship model, you will find our full-size blueprints of invaluable help. Every experienced model maker knows that the task is greatly simplified if the work can be compared directly with the plans to make certain all parts have been cut correctly. Plans are available for about fifty different ship models, including our new whaleboat model.

We also have blueprints for furniture, radio sets, canoes, boats, toys, and novelties. A partial list of projects is given below, but it is advisable to send a stamped, self-addressed envelope for the complete list.



MODELS

Aircraft Carrier <i>Saratoga</i> (18 in.) and a Flush-Deck Destroyer (6 1/4 in.), 226-227-R.....	.75
<i>Bluenose</i> , the famous fishing schooner, 17 1/2-in. hull, 110-111-112-R.....	1.00
Barnegat Lighthouse, 298A.....	.25
Brig <i>Malek Adhel</i> (20-in. hull; frame-and-plank construction), 304-305-306-R....	1.25
Clipper Ship <i>Great Republic</i> (31 1/2-in. hull), 272-273-274-R.....	1.25
Clipper Ship <i>Sea Witch</i> (9 1/2-in. hull), 219	.25
Coast Guard Patrol Boat (20 5/8-in.), 286-287-R.....	.75
Cody Coach (body 13 in. long), 144-145-146-R.....	1.00
<i>Constitution</i> ("Old Ironsides"), 21-in. hull, 57-58-59-R.....	1.00
Covered Wagon (23 1/2 in.), 118-119-120-R.....	1.00
Cruiser U.S.S. <i>Indianapolis</i> (12-in.), 216....	.25
Farragut's Flagship <i>Hartford</i> (33 1/2-in. hull), 221-222-R.....	1.50
Felucca or Barbary Pirate Galley (20 in.), 44-45-R.....	.75
Freighter, <i>Ocean</i> (14-in.), 271.....	.25
H. M. S. <i>Bounty</i> (8 1/2-in. hull), 254.....	.25
Liner <i>President Lincoln</i> (14 3/4 in.), 325....	.25
<i>Mayflower</i> (24 in.), 83-84-85-R.....	1.00
New Bedford Whaleboat (14-in.), 326....	.25
<i>Normandie</i> (20 5/8-in. hull), 264-265.....	.50
Privateer <i>Swallow</i> , Baltimore clipper, (13-in. hull), 228-229-230-R.....	1.00
Racing Yacht <i>Seascout</i> (42-in.), 106-107-R.....	.75
Roman Galley (19-in.), 138-139-R.....	.75
Ship Model Weather Vane, 66.....	.25
<i>Sovereign of the Seas</i> , clipper ship (20 1/2-in. hull), 51-52-53-R.....	1.00
Spanish Treasure Galleon (24 in.), 46-47....	.50
Stagecoach with Horses, 144-145-146-R.....	1.00
Trading Schooner (17 1/2-in. hull), 252-253....	.50
U. S. Battleship <i>Texas</i> (3-ft. hull), 197-198-199-200.....	1.00
U. S. Destroyer <i>Preston</i> (31 1/2 in.), 125-126-127-R.....	1.00
Viking Ship (20 1/2-in.), 61-62-R.....	.75
Whaling Ship <i>Wanderer</i> (20 1/2-in. hull), 151-152-153-154.....	1.00
Yacht <i>Rainbow</i> (7 1/2-in. hull), 233.....	.25

(Construction kits are available for some of these models. See page 22.)



FURNITURE

Cedar Chest, 17.....	.25
Child's Costumer, 179A.....	.25
Colonial Writing Desk, 21.....	.25
Early American Round-Top Stand, 191A....	.50
End Table, American Empire, 241A.....	.25
Fireside Bench, Colonial, 187A-188A.....	.50
Floor Lamp (tripod base), 243A.....	.25
Four-Leaf Card Table, 239A.....	.25
Gate-Leg Table with Round Top, 24.....	.25
Hanging Wall Cabinet, 280A.....	.25
Magazine Rack and Wooden Wastebasket, 296A.....	.25
Maple Tavern Table, top 30 by 68 in., 318A.....	.50
Modernistic Lamps (three designs), 93.....	.25
Queen Anne Dressing Table, Stool, and Mirror, 295A.....	.75
Reading Tables, Two, 68.....	.25
Sewing Table, 1.....	.25
Silverware Chest on Stand, 256A.....	.25
Six-Footed Coffee Table with Top 14 by 26 in., 14 in. high, 327A.....	.25

Smoking Stand, Modern, 238A.....	.25
Telephone Table and Stool, 18.....	.25
Tilt-Top Table (turning), 140.....	.25
Treasure Chests (metal bindings), 78.....	.25
Upholstered Stool, 240A.....	.25



BOATS

Canoe, 16-ft. Canvas-Covered Kayak, with sail, etc., 192-193-194-R.....	1.00
Camper's Utility Boat (11 ft. 2 in. long, canvas-covered, for outboard motor or rowing), 281-R.....	.50
Canvas-Covered Duck Boat (13 ft. 6 in. long), 279-R.....	.50
Folding Duck Boat (13 ft. long), 170-R.....	.50
High-Speed Boat for Small Outboard Motors (7 ft. 11 in. long), 257-R.....	.50
16-ft. Motorboat - Rowboat (has decked hull; for use with outboard or inboard drives and oars), 149-R.....	.50
Outboard Racer for Class "A" and "B" Motors, (10 ft. 4 in. long), 211-212-R.....	.75
Racing Runabout (13 ft. long, for outboard motor), 261-262-R.....	.75
Racing Sailboat <i>Blackcat</i> (13 ft. 4 in. long, 5 ft. beam, weighs 250 lb., Marconi rigged), 321-322-323-R.....	1.00
Sailboat (12 ft. long; weighs 200 lb.; has fast skimming-dish hull), 314-R.....	.50
Sport Runabout (9 ft. 8 in. long, 43-in. beam, for small outboard motors), 309-310-R.....	.75
Utility Rowboat, 13-ft., (can also be sailed or driven by outboard motor), 224-R.....	.50



RADIO SETS

All-Wave Portable Receiver (two tubes, operated by battery), 217-R.....	.50
Amateur Short Wave Receiver, 155.....	.25
Amateur Radio Transmitter, 183-184.....	.50
Five-Tube Short Wave (A.C. or D.C.), 223.....	.25
Full Electric Headphone Set, 130.....	.25
One Tube (battery operated), 103.....	.25
Screen-Grid Set, 109.....	.25
Short-Wave Converter Unit, 137.....	.25



MISCELLANEOUS and TOYS

Arbor and Garden Gate, 9.....	.25
Baby's Crib and Play Pen, 26.....	.25
Block Puzzles (six), 65.....	.25
Cigarette Holder (in form of miniature three-gun naval turret), 299A.....	.25
Colonial Doll's House, 72.....	.25
Doll's House Furniture, 73.....	.25
Flowerpot Stand (38 1/2 in. high) and Novel Modern Table Lamp, 317A.....	.25
Four-Treadle Hand Loom, 268A-269A.....	.75
Log-Cabin Bird House, 244A.....	.25
Metal Sundial (concrete pedestal), 291A....	.25
Patterns for Jig-Sawing Birds and Animals, 56.....	.25
Projector for Photos and Pictures, 259A....	.25
Simple Jewelry Designs, 298A.....	.25
Toy Fire Engine, Dump Truck, etc., 101....	.25
Toy Lathe, Drill Press, Saw, and Jointer (driven by small motor), 113.....	.25
Turned Costume Jewelry, 275.....	.25
Wood Mosaic Serving Tray and Novelty Book Ends, 297A.....	.25

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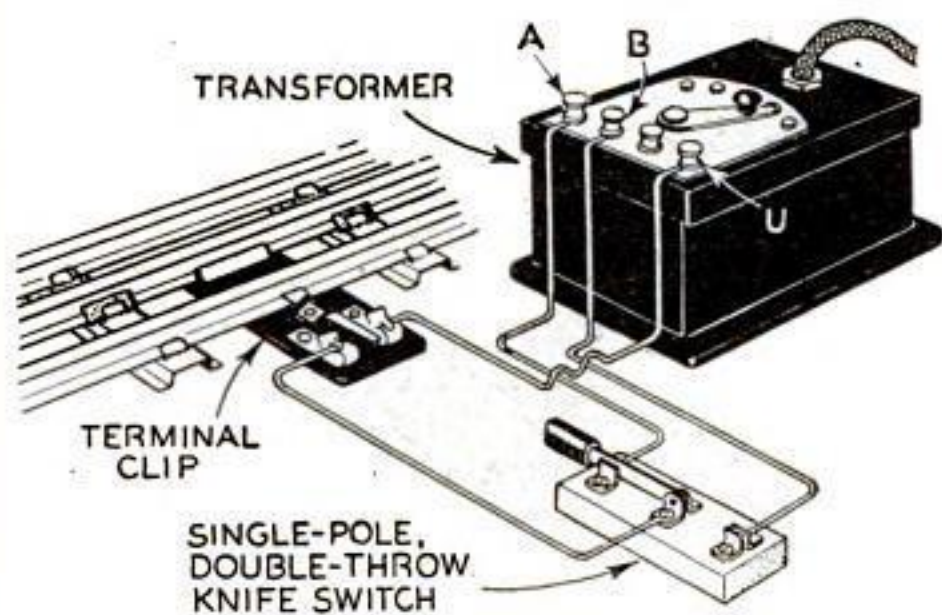
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Two Colorful Ash Trays

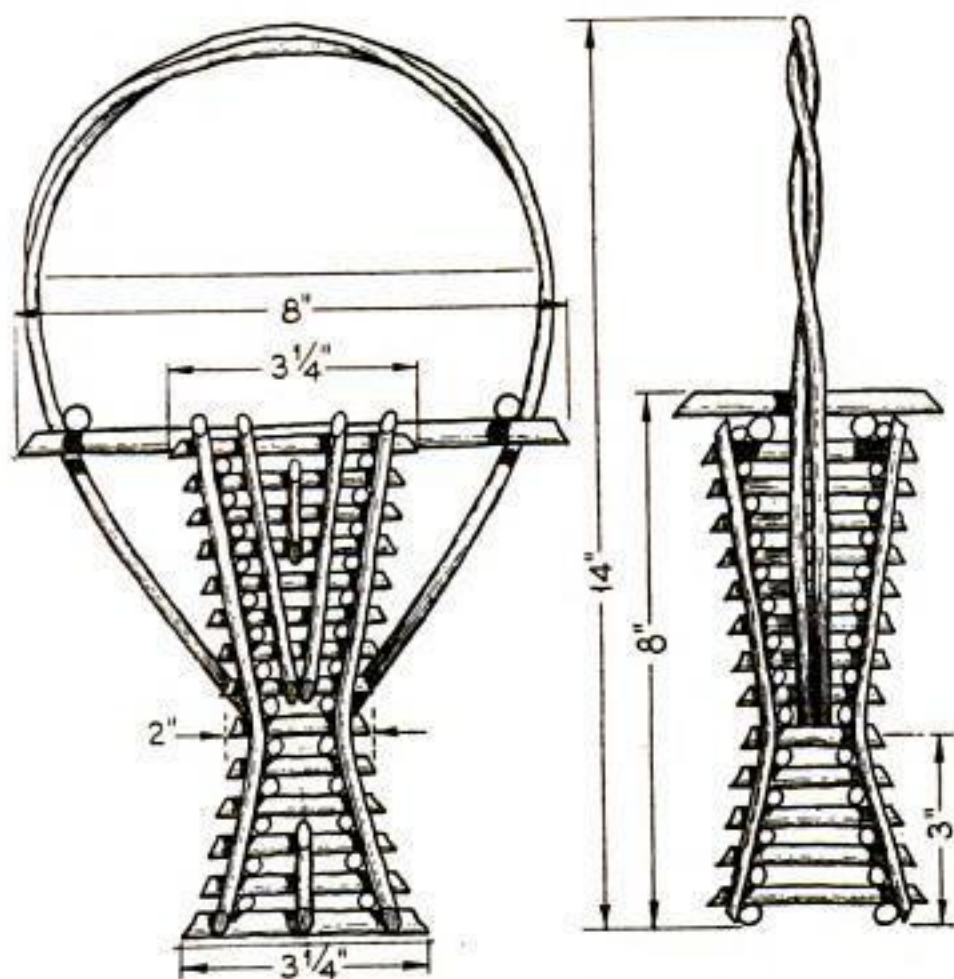
(Continued from page 95)

shape curves on ends to $\frac{3}{4}$ -in. radius, turn recess to fit tray, drill and counter-bore holes as indicated on drawing, sand the block thoroughly, and apply a clear lacquer. (Fill walnut block with dark wood filler before lacquering.)

Plastic Cigarette Rest. Sand recess to $\frac{7}{8}$ -in. radius on drill press with sanding drum; then sand all over with 7/0 garnet paper, buff with polishing compound, saw to correct length, drill $\frac{5}{32}$ -in. hole $\frac{3}{8}$ in. deep for walnut tray and $\frac{1}{4}$ in. deep for maple tray, and tap for bolt.

Rustic Flower Basket

(Continued from page 94)



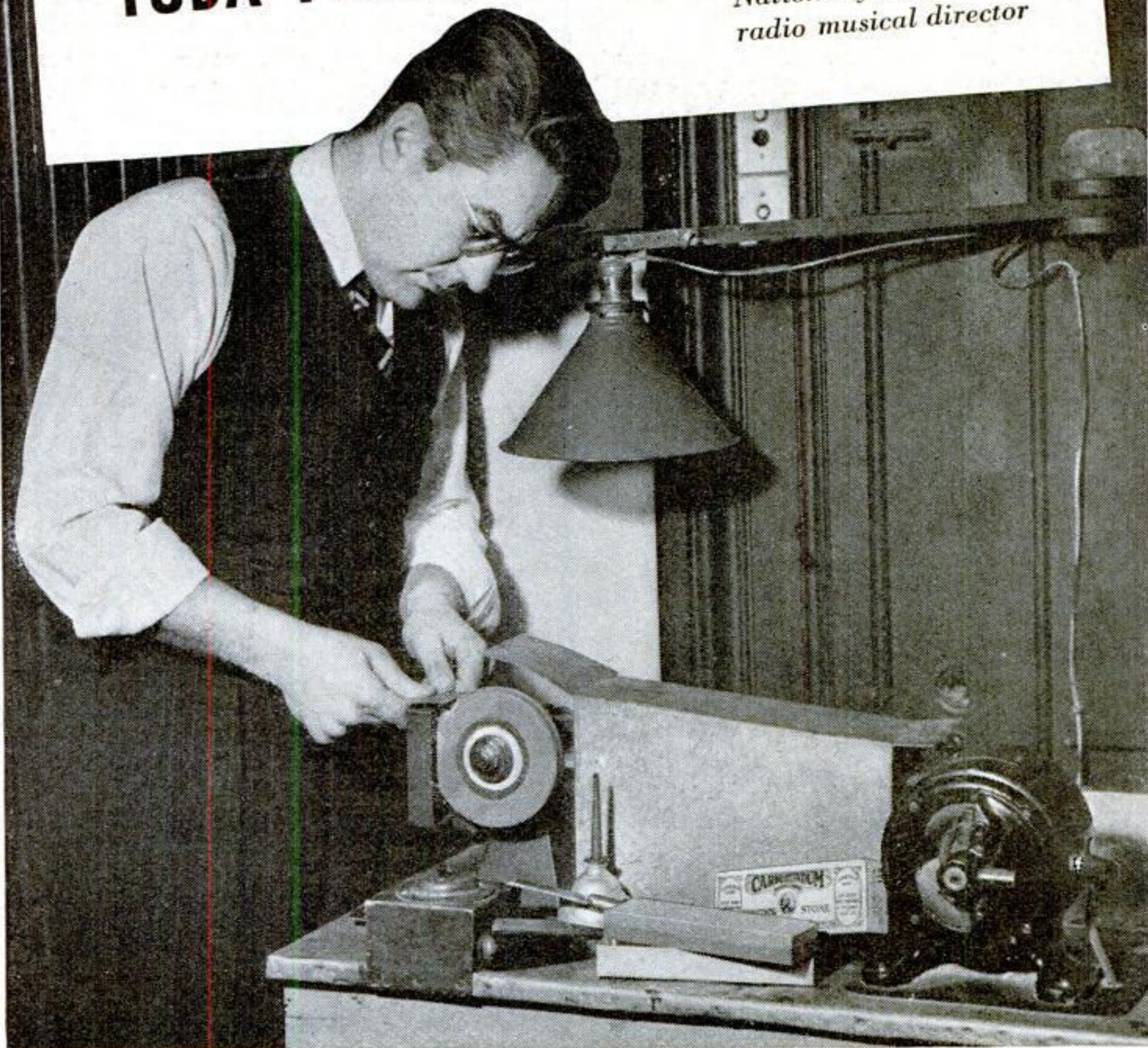
Method of assembling the willow sticks

material for all four sides. The sticks are then laid one upon the other in log-cabin style, and a small brad is driven down through each end. The corner sticks are next bent and nailed in place, the ornamental side sticks are nailed on, and the two long top rails with cross-pieces fastened. The handle consists of two pieces of willow twisted two or three times, with the ends inserted at the small part of the basket.

The basket is allowed to dry until the bark has turned brown. It is then varnished, and the cut ends of sticks painted with gold paint.—HAROLD JACKSON.

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Improving Your Color Movies

(Continued from page 114)

the center of the scene where the light strikes it squarely, as shown in the opening illustration, and take your reading from that. Then, by using the factor for color film recommended by the meter makers, you will come close to being right. If the resulting film is on the bright side, use a card of a lighter gray or a higher factor in setting the meter. If the film as projected seems a bit dark, shift to a darker card or a lower meter factor. This method works outdoors by daylight or indoors by artificial light. Obviously, however, the card must be a neutral gray, not tinted in any way.

Much color film is spoiled in working out the lighting of the subjects. The textbooks and instruction sheets on this subject unite in recommending flat lighting, which means having approximately the same amount of light reach all surfaces of the subject. It is the color contrast and not the light-and-shadow contrast that makes the picture. You might have a certain subject which, with flat lighting, would give almost no picture in black and white and yet might still give a brilliant color picture.

HOWEVER, the flatness of the lighting should not be carried too far, otherwise a sort of a pastel effect is obtained. The human eye is accustomed to seeing shadows as well as color.

An example of this is given in the two illustrations on the first page of this article. One shows a face with extremely contrasty lighting; it is poor in black and white and would be much worse in color. The other represents about as flat a lighting as is desirable for color work. All the surfaces are receiving a generous amount of light, yet there still is enough shadow effect to give the color image the depth and roundness that makes it look really lifelike.

Indoors by artificial light, you can control the light to get just the effect you want. This effect is most easily obtained if the light sources on each side of the subject are of equal strength, but the lights on one side are a trifle nearer to the subject than are the lights on the other side. Another way that is quite effective is to light your subject uniformly from both sides and then throw the beam of a spot light on the subject from one side, the extra high lights thus produced greatly improving the result.

In filming outdoor scenes with color film, you must, in most cases, take the lighting that nature provides, but if you have a choice in the matter, always choose a time when the sunlight is as uniformly distributed over the scene as possible, with few if any deep shadows.

Color movies taken outdoors by sunlight are not so good if you do the filming when the sun is very high in the sky, particularly if your subjects are surrounded by dark green foliage. The eyes of your subject are likely to look like holes burned in a blanket.

If you find it necessary to shoot without waiting for a slanting or more favorable light and you can move your subjects to a point where a light foreground will reflect light to the faces and thus soften the effect a bit, the difficulty can be overcome to a large extent by spreading white sheets of paper or cloth in front of your subjects just outside the field of view taken in by the camera.

The use of white reflectors is equally

useful in improving results when the sunlight is strongly from one side. In such cases, the sheets of newspaper or white cloth should be held at an angle on the dark side of the subjects so that the reflected light will lighten up the shadows.

The introduction of color movie film has brought new problems to the amateur movie maker on the question of suitable titling. The use of ordinary black-and-white positive film for making titles results in such contrast between the full color of the scenes in the film and the complete lack of color in the titles as to prove offensive to the eye.

A simple solution is to make titles on positive stock that has a tinted celluloid base. It can be obtained in several colors such as light amber, candlelight, and purple haze.

If you wish some particular shade of color for your titles, it is entirely practical to dye plain positive film to get the effect you want. First make tests with a small solution of dye in a water glass, using 4- or 5-in. strips of film, till you find the strength of solution and time of immersion that will give the shade of color you want. Then make up a gallon bottle of the solution, push the title film down into it as shown and wedge the end tightly under the cork. Now place the bottle on its side and keep it rolling back and forth for the necessary time.

Another difficulty that will crop up in titling color movie film is the difference in focusing register between the color film and the positive stock. You may find, after you have spliced in your titles, that when you focus sharply on the color scenes, the titles appear out of focus or vice versa. This difficulty is caused by the peculiar convex curve that color film takes when it dries, and it can to a large extent be overcome by winding the film quite tightly and by keeping it that way.

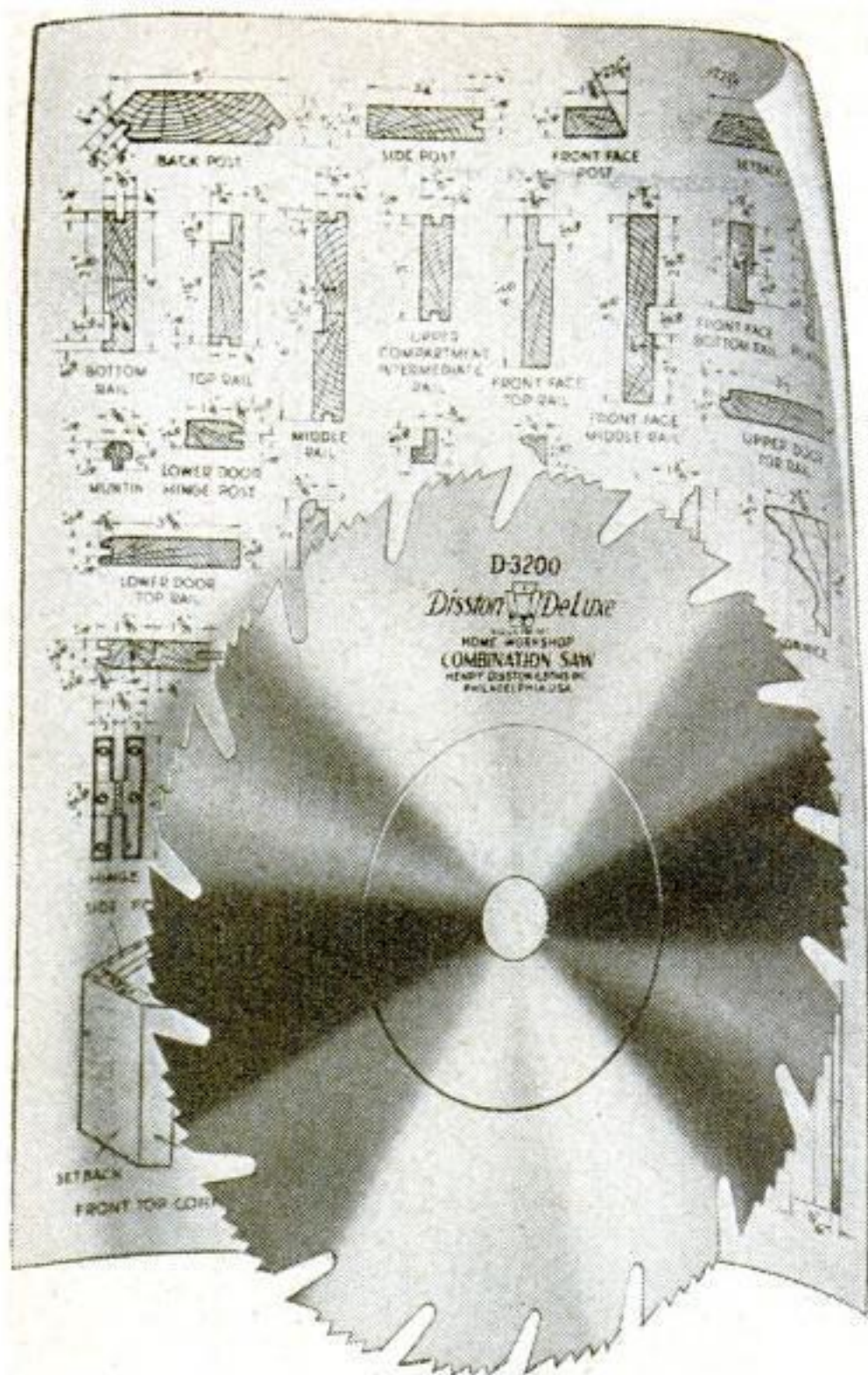
A complete cure is to make your titles on color film instead of on ordinary positive stock. In fact, you can even get color results from plain black-and-white title cards by using a filter over the lens. With an "A" filter in front of the lens, for example, you will get black letters against a brilliant red background. Through a "B" filter you will get black letters on a strong green background.

Getting Greater Duration from Model Airplanes

WHEN entering an outdoor flying airplane model in a contest, certain factors must constantly be kept in mind if the ship is to give its best performance. These hints are particularly applicable to the "Contestant" model (see P.S.M., Sept. '37, p. 92).

Rubber loses power, turns, and pep in ratio to the heat of the day, so keep the model covered and in the shade. Also make the spare motors at home, not on the field. Give the motor a breaking test before going to the contest.

In flying, carefully note the field. Keep away from buildings when launching, as they produce turbulent air. Launch the ship slightly in front of any terrain that has thermal qualities, such as a plowed field, concrete runway, and any closely packed area. The up-currents are strongest from twenty-five to a hundred feet above the area.—FRANK ZAIC.



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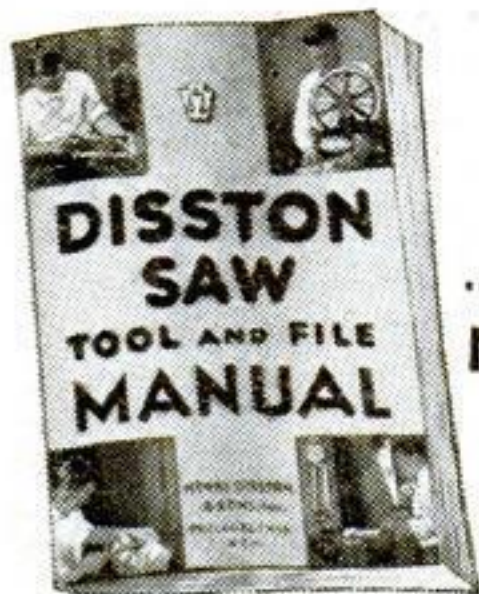
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6" (1 1/2" hole) \$2.70 8" (1 1/2" 5/8", 3/4" hole) \$3.50
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Modern Trestle Table

(Continued from page 98)

edges and boring a $\frac{1}{2}$ -in. hole $2\frac{3}{4}$ in. from either end for the dowels. These three pieces may now be securely glued and doweled together.

Mark off the angular cut at the top of each of the four trestle legs, and the angle and depth of the halved cross-lap joints as shown on the plan. Saw the waste wood away at the top of the legs, saw the shoulders of the notches to the gauge depth, and chisel to the line on each side. Fit the trestle legs together in pairs, and bore and countersink $\frac{1}{4}$ -in. holes to receive the 4 by $\frac{1}{4}$ -in. bolts. Chamfer the edges on all four legs as indicated. Bore and countersink screw holes in the top and bottom of the legs as shown, and screw the trestles tightly into position on the base pieces.

Make the two $1\frac{1}{2}$ by 2-in. cleats. Bore and countersink screw holes to fasten the cleats to the underside of the table top and to the tops of the trestle legs. Lay the table top on sawhorses or on the floor, underside up, and mark the position of the cleats. Screw them down tightly into place, and then finish the assembly by screwing the trestle legs down to the table top and to the cleats.

Stain or finish in the natural color of the wood as desired or according to the kind of material used. Keep in mind the fact that this table is likely to receive a great amount of use and that a simple wax finish is more in keeping with the style and may be more serviceable than a varnished or highly polished surface would be.—W. W. WHEATLY.

LIST OF MATERIALS

No. Pc.	Description	T.	W.	L.
2	Base	3	$4\frac{1}{2}$	30
1	Stretcher	$1\frac{3}{4}$	$3\frac{1}{2}$	62
4	Trestle legs	2	$3\frac{1}{2}$	$34\frac{1}{4}$
2	Cleats	$1\frac{1}{2}$	2	23
4	Table top	$1\frac{1}{4}$	$7\frac{1}{2}$	84
2	Dowels for stretcher	$\frac{1}{2}$		$2\frac{1}{2}$
21	Dowels for top	$\frac{3}{8}$		$1\frac{1}{2}$

NOTE: All dimensions are given in inches and are finished sizes. The material may be either hard wood or good quality soft wood. The four table-top pieces are to be glued up to form the 30-in. wide table top.

Screws: 8— $2\frac{1}{2}$ -in. No. 12 flathead bright wood screws to fasten cleats to underside of table top; 8— $3\frac{1}{2}$ -in. No. 14, for bottom of legs; 4—2-in. No. 14, for top of legs; 4—2-in. No. 12, to fasten tops of legs to cleats.

Bolts: 2—4 by $\frac{1}{4}$ -in. machine bolts.

Airplane Furniture

(Continued from page 99)

used under the springs. Do not nail it because it must be removed like bed slats if the bed is ever moved. The rack for the drawers also is removable; it should be screwed in after the bed is set up in place. The 3 by 6-ft. mattress and springs are standard and can be obtained at any furniture store.

The desk also is made of standard dimension lumber as shown. The chairs are equally easy to build. They can be upholstered with canvas pads or used without, as preferred.

When the set is done, call in your wife and suggest that she make bedspreads and curtains to match, with blue airplanes appliquéd on them.—S. H. POGUE.

How a Man of 40 Can Retire in 15 Years



IT makes no difference if your carefully laid plans for saving have been upset during the past few years. It makes no difference if you are worth half as much today as you were then. Now, by following a simple, definite Retirement Income

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This important benefit is available alone; but if you are insurable, your Plan can also include:

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3 A monthly disability income for yourself if, before age 55, total disability stops your earning power for six months or more.

Best of all, the Plan is guaranteed by a reliable, old company with over half a billion dollars of insurance in force. If you want to retire some day, and are willing to lay aside a portion of your income every month, you can have freedom from money

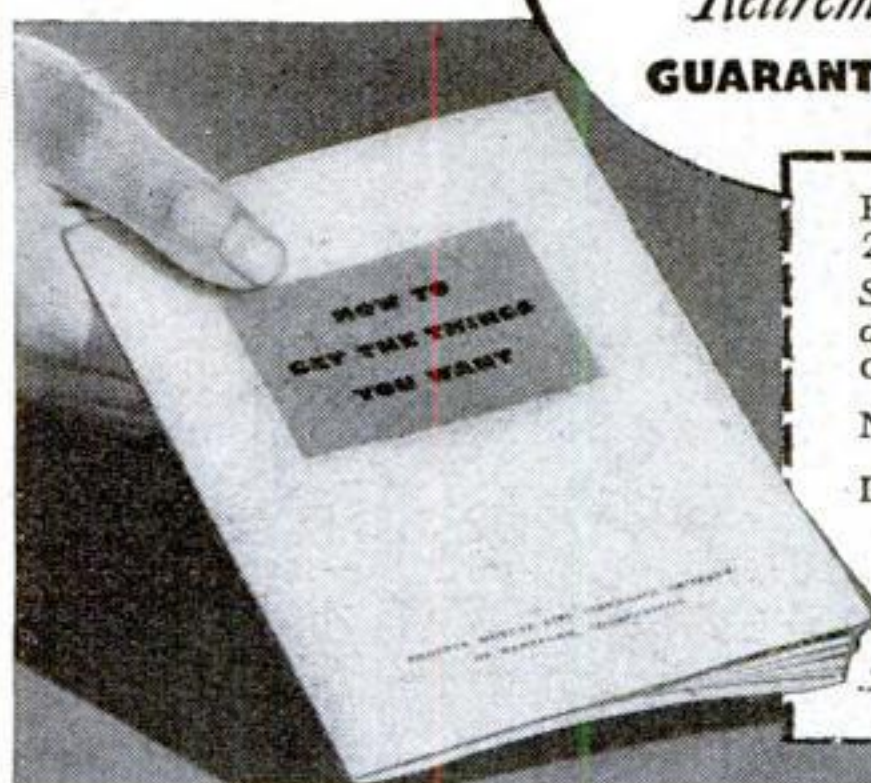
worries. You can have all the joys of recreation or travel when the time comes at which every man wants them most.

The Plan is not limited to men of 40. You may be older or younger. The income is not limited to \$250 a month. It can be more or less. And you can retire at any of the following ages that you wish: 55, 60, 65, or 70.

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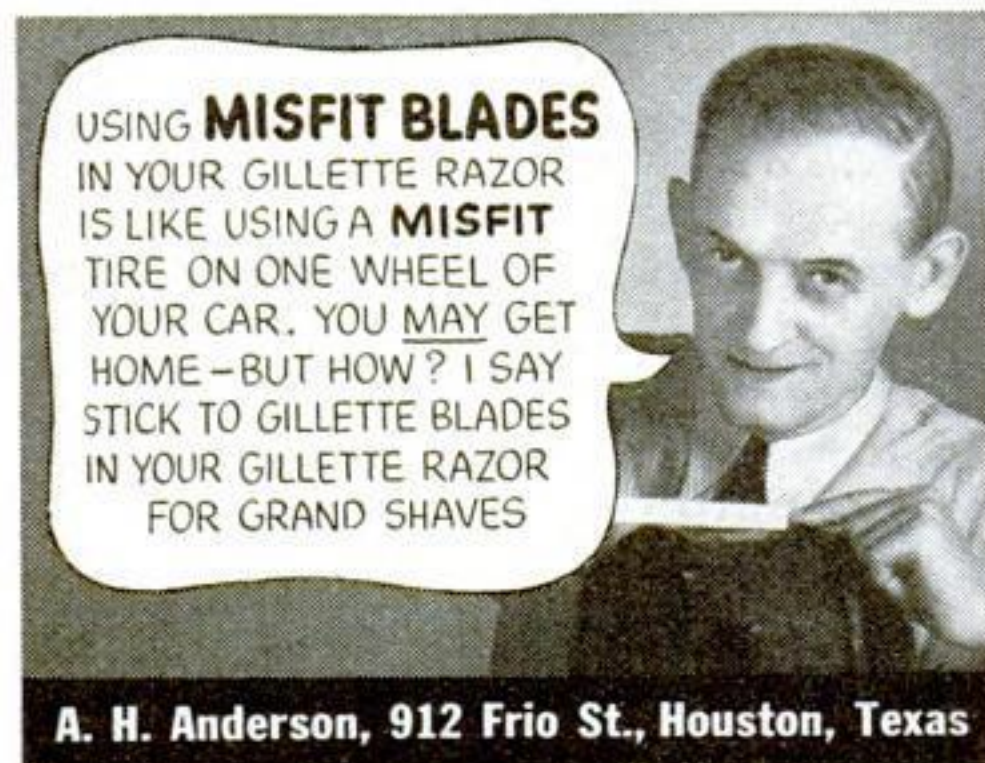
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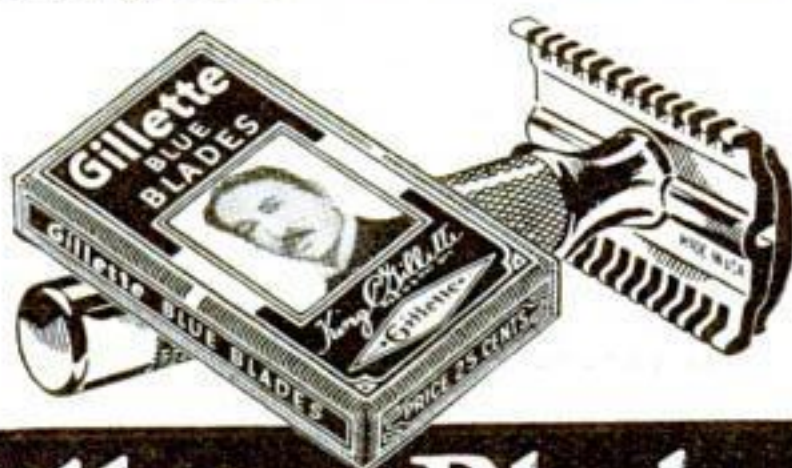
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Gillette Blades
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Mirror-Frame Hints

(Continued from page 105)

A modern adaptation of the early American motif, in design and color, is shown on the first page of this article. In this case, no mirror was available for the highboy, so it was necessary to design one. The cover of the tie box was taken as the desired width of the new mirror, while the height was determined by making a scale drawing to represent the body of the highboy, as shown in the diagram on page 105, and then proceeding as follows:

Diagonal X-Y was drawn, then distance Y-C was laid off equal to A-B, the top of the tie box. A perpendicular line was erected from C, and a horizontal line D-E was drawn, thus giving a



Silhouette mirror
with rebuilt frame

rectangle in exact proportion to the original highboy. This method can be enlarged when necessary by extending the diagonal.

Choice stocks of figured and curly maple were used to make the split, turned pilasters and other parts. The panels were veneered in crotch satinwood. The finishing was done in a light yellow tone comparable to varnish on fine woods after some fifty or seventy-five years of use, as follows:

1. Complete all cabinetwork; assemble with screws.
2. Disassemble, sponge with clean water, dry, sand with 6/0.
3. Stain with standard light "honey maple" or use 2 oz. potassium dichromate per gallon of hot water. Dry twenty-four hours.
4. Seal with one part of orange shellac reduced with five parts denatured alcohol. Apply lightly and evenly. Dry hard; sand 6/0.
5. Brush on a light, even coat of four-hour floor varnish. Dry twenty-four hours and sand with old 6/0 paper.
6. Brush on a full-bodied coat of varnish. Dry two days.
7. Rub with FFF pumice stone, crude oil, and felt.
8. Finish with wad of cotton waste wet in water to remove oil sludge.
9. Wipe and polish clean. Keep finish thin on maple.

A form of Chippendale mirror that is suited to both wide horizontal and narrow vertical treatments is illustrated in two photographs. In one the wide frame cut-outs are veneered with an open crotch walnut; in the other, with narrow strips of cross ripple. Both veneers were chosen to accent the particular treatment as well as to harmonize with that of the cases displayed below.

The specifications:

1. Assemble frames.
2. Stain walnut and maple.
3. Shade all corners of maple frames within margins of cut-out panels with a sprayed-on touch-up stain coat or by ragging on walnut stain, then sanding out as required with 6/0 old paper. Have shaded portion blend into lighter maple with no appearance of abruptness.
4. Complete finishing as in preceding schedules.



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WINCHESTER

Trindl ELECTRIC ARC WELDER

Works Off Any Storage Battery or Ordinary Light Socket...

This New Electric Arc Welder is made possible by the invention of a low voltage carbon. Auto batteries may be used without removing from car. Uses about same current as four headlight bulbs. Can be used on electric light socket by using a Trindl Converter in place of battery. Broken parts are **SIMPLY MELTED TOGETHER** by the white HOT electric arc, in just a few seconds. Produces about 7,000 degrees heat.

Hottest Flame Known
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Save money, have fun developing, printing your own pictures! No experience needed. Everything included in Central's complete Dark Room Outfit "B" pictured to right: Ruby Bulb, (3) 4x6 Enamel Trays, 5 Tubes Universal Developer, 1lb. Acid Fixer, 20 Sheets 3 1/4 x 5 1/4 Printing Paper, Glass Stirring Rod, 3 1/4 x 5 1/4 Metal Printing Frame, Central Thermometer, 4 oz. Graduate, Exposure Record Book, 2 Stainless Steel Clips, 24 Page Book Amateur Photography including easy instructions.

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POPULAR SCIENCE MONTHLY

Aid for Damp Cellars

(Continued from page 109)

although it is a little messy to use. Whatever compound you choose, however, should be added to the concrete mixture in accordance with the manufacturer's instructions.

For the concrete mortar itself, a mixture of three parts of clean sand to one part of cement is satisfactory. Mix these well and add just enough water and waterproofing compound (if liquid) to produce a stiff, thick paste. Now wet the surfaces where the mortar is to be applied with a very thin mixture of cement, water, and waterproofing compound. Before this "primer" dries, spread the concrete mortar on thick, and smooth it out with a rectangular-shaped trowel. Corners can be worked in with a small triangular trowel as shown in the photograph. If you are particular about the appearance of the job, a uniform curve can be given to the cove by smoothing it out with a milk bottle.

If you use emulsified asphalt as a waterproofing compound, it is best to finish off all concrete work containing the asphalt with a thin coating of cement, fine sand, and water applied with an old whisk broom shortly after the other concrete has begun to set. This treatment gives a white coating over the black, asphalt-impregnated concrete.

After the concrete work has been completed and is thoroughly dry, the whole cellar can be given a dust and damp-proofing treatment with sodium silicate (water glass) or some similar chemical. A solution of one part of sodium silicate to four parts of water is satisfactory. Apply by pouring onto the cellar floor and brushing around with a broom until all the concrete to be treated is saturated. Let it dry, then scrub down with water. For best results, repeat this treatment several times.—R. H. Ross.



Home Repairs for October

NOW that the hot summer months are over, you will feel more like making improvements and doing odd jobs around the home. Ten suggestions for October follow:

- Reupholster old chairs.
- Install new sink in kitchen or pantry.
- Clean wallpaper. Repaper where necessary.
- Build a storage rack for screens.
- Preserve old trees by filling decayed portions with concrete.
- Apply weather stripping to windows and doors.
- Flush out hot-water tank to remove sediment.
- Make certain furnace is in good condition for winter use.
- Renew floors with new material—linoleum, paint, lacquer, varnish, or wax.
- Construct a cold compartment in cellar for canned goods, fruits, and vegetables.

LET COLOR transform your home IN A SINGLE DAY!



EASY, INEXPENSIVE WAYS TO MODERNIZE!



RENEW SCUFFED, WORN FLOORS

Pittsburgh Florhide Enamel gives painted floors, steps, porches a tough, high-gloss finish that's not only beautiful, but easy to keep clean. Try it on your garage floor, and in your kitchen—wherever service is hard! And Florhide is a splendid finish for concrete, plaster, stone and metal surfaces.



DINGY WALLS RE-GLORIFIED

Cold rooms grow warm and friendly, small rooms seem miraculously larger when walls and ceilings are finished with Pittsburgh Wallhide, in gay, youthful hues! This famous "Vitalized Oil Paint" applies easily, dries quickly, withstands frequent washing. In 15 soft-petal shades and 12 semi-gloss colors.



RENEW FURNITURE QUICKLY

Bring all your old furniture up-to-date, make it harmonize with your newly-painted rooms! You can do this yourself in a jiffy with Waterspar Enamel, and it's fun! There are 18 beautiful shades.

MAKE over your home in gay, harmonious colors in a single day! Finish walls, ceilings, floors, woodwork—even the furniture—between dawn and dusk! Banish dull, drab rooms. Make dark hallways gleam. Put life in your kitchen and bathrooms. It's simple and it's inexpensive—with Pittsburgh's famous *one-day painting* products!

Highest Quality Paints

Pittsburgh originated the quick-drying finishes that made one-day painting possible. Back of these is a record of 80 years of fine paint making. Every step in the manufacture of Pittsburgh Paints is under rigid laboratory control. Gruelling tests *prove* that there's actually more wear in every brushful. *Pittsburgh* colors are *anchored*!

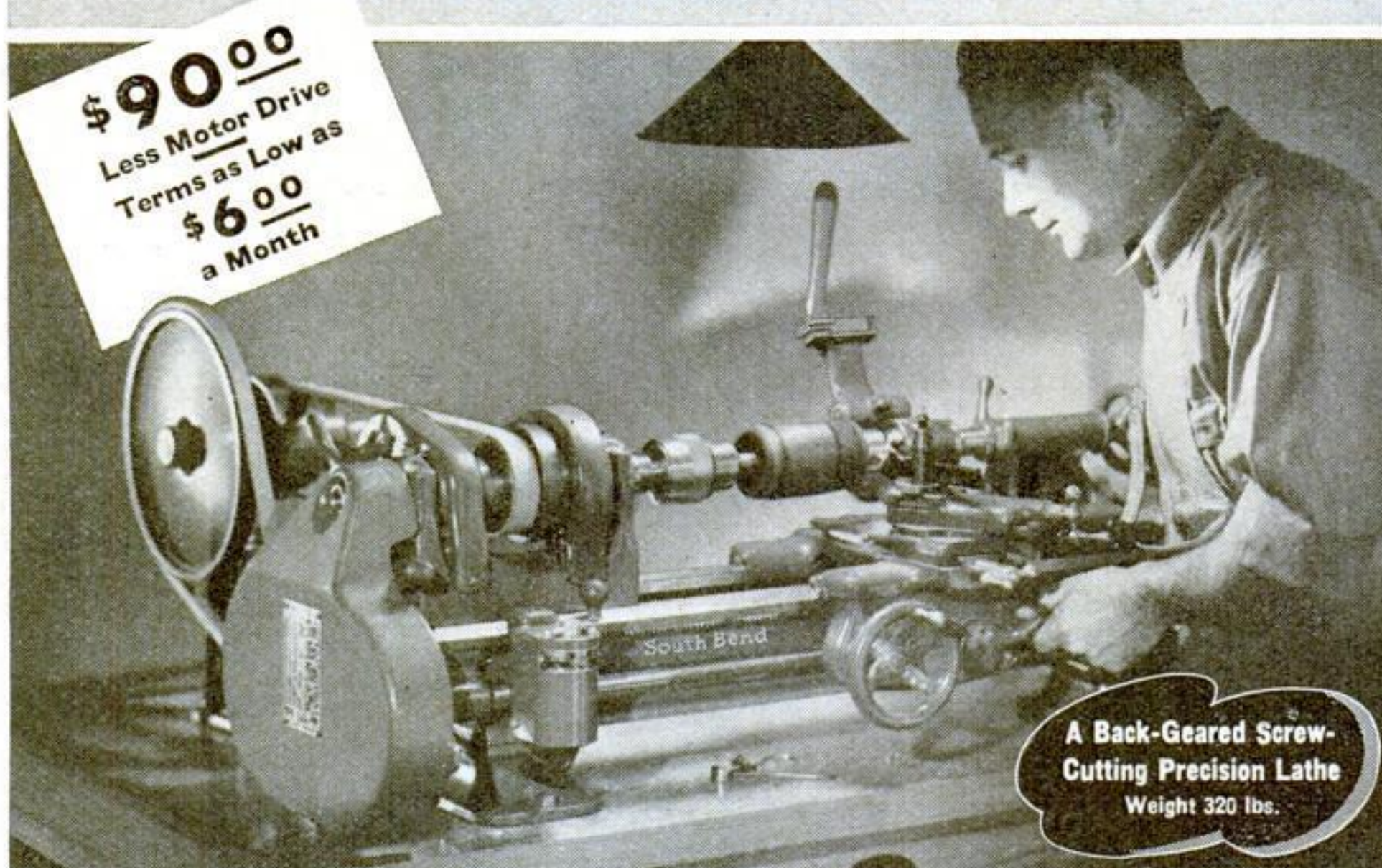
Free Advisory Service

Ask your nearest Pittsburgh dealer to show you the wide range of Pittsburgh shades and colors. You'll find his name in the classified section of your local 'phone directory. If you have a special decorating problem, write the studio of Creative Design for free consultation service. Pittsburgh Plate Glass Company, (Paint Division), Pittsburgh, Pa.

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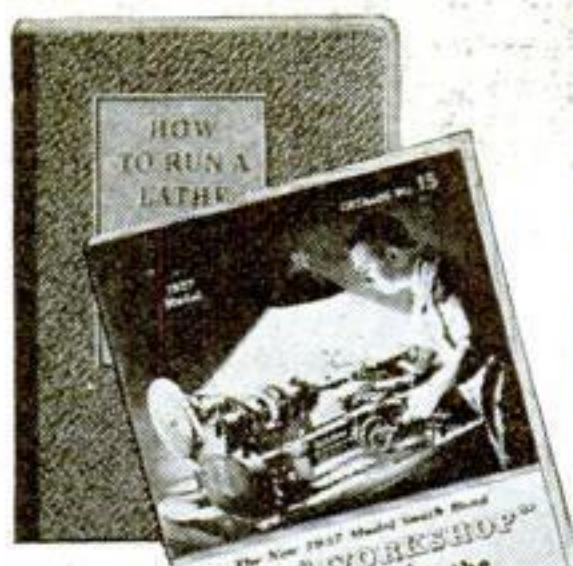
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No. 415-YA, 9 1/4" swing by 3' bed Workshop Bench Lathe with Adjustable Belt Tension Countershaft, 1/4 H.P. Reversing Motor, Switch and belts **\$12200**
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The 9-inch Workshop Lathe is a Precision Lathe with Back Gears, large V-ways on lathe bed, a Precision Lead Screw, and is designed to handle the most accurate jobs in manufacturing—in the tool room, in home workshops and automotive machine shops. Other features include Twin Gear Reverse to lead screw, Ball Thrust Bearing on Spindle, and Automatic Longitudinal Screw Feed to Carriage. Takes 38 attachments.

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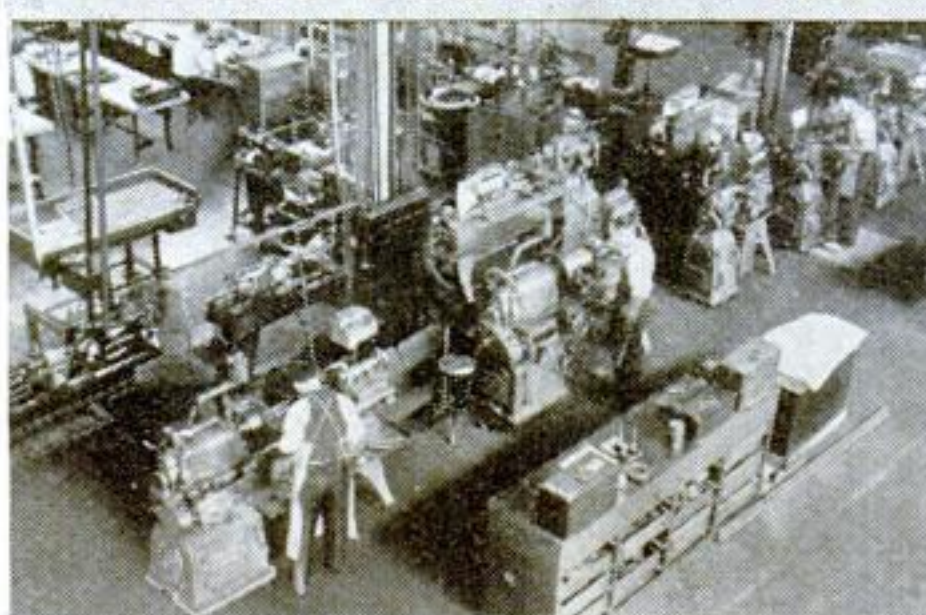
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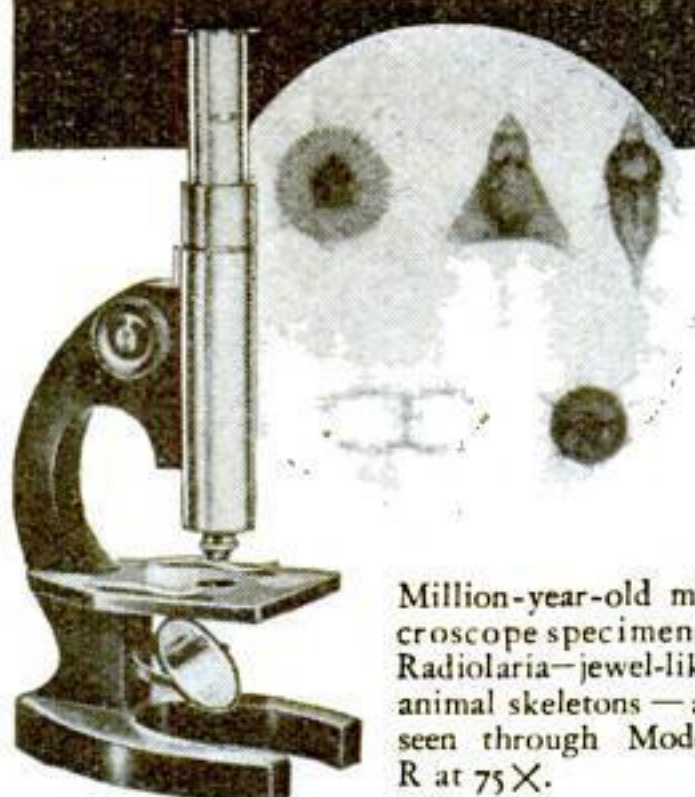


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Two types of scales are seen in this view of a moth's wing. Some project from the edge like hairs, others overlap like shingles

Studying Insect Hairs Under a Microscope

(Continued from page 77)

an insect (*Dermestes*) that is found in museums, where it causes trouble by eating dried skins and furs, has a particularly elaborate hair. It is decorated along its shaft by whorls of spines, and near the tip is a cluster of considerably larger spines, surmounted by a set of about six hinged ribs which somewhat resemble the skeleton of an uncovered, partly-folded umbrella. On the legs of spiders, honeybees, and a great many other creatures, you can find hairs that are branched—hairs on other hairs.

While hairs probably provide general body protection, frequently they are developed into highly useful implements, as, for example, in the honeybee. Its head is covered largely with branched hairs, but along its legs the hairs are stiff spines. Projecting among the facets of the compound eyes are numerous hairs. Likewise, the bee's antennae are hair-covered. It is probable that these antennae hairs are connected with nerves, and that they help the bee to get around. Such hairs are called tactile hairs.

BECAUSE the bee's antennae hairs become clogged with pollen as it works, thus dulling its sense of touch, it has on its first legs a set of antenna cleaners, concave combs with spinelike teeth. The same legs have pollen brushes composed of stiff hairs, which are used to handle collected pollen. Also there is a pair of eye brushes, used for cleaning pollen from the hairs surrounding and covering the compound eyes. Structures of special construction, composed largely of hairs or spines, are found on other legs. Each foot is provided with a battery of tactile hairs, sensitive to touch.

Other insects besides the bee frequently are equipped with hairs modified for special uses. The spider depends largely on the hairs of its legs and feet to keep it from slipping off the strands of its web. Doubtless, insects such as ants, which burrow through the earth, depend on sensitive hairs to guide them about. At any rate, the hair in some form or other is a highly important piece of insect equipment, and one that merits close attention.

Half the fun of exploring the insect world with the microscope is the making of permanent (Continued on page 129)

Studying Insect Hairs Under a Microscope

(Continued from page 128)

mounts of interesting specimens. You will, therefore, treasure a set of slides containing such objects as moth-wing scales, mosquito wings and legs showing scales, spider skins, ant skeletons, and bits of skin from insect larvæ that have hairs of unusual form.

If the insect is small, you can mount it whole. Then you can study its other features as well as its scales or hair. Insects that are small and soft, or their larvæ, can be mounted directly in pure glycerin, sealed under a cover glass with gold size or other sealing material. If you are interested only in the hairs or scales, you need not worry much about possible distortion of the body shape through improper handling or too rapid removal of water.

ANOTHER common way of mounting small insects such as lice and fleas is to drop them into strong carbolic acid, which removes water and clears them at the same time. Then transfer them directly to a drop of balsam on the slide. Some workers prefer to clear the specimens further by placing them in xylol for a time before transferring to balsam. Perhaps the simplest method of preparing small insect specimens is to drop them into turpentine for at least an hour, and then mount them in balsam. This method can be used with mosquitoes and similar specimens.

Clusters of hair from the bodies of woolly caterpillars and other larvæ, bits of butterfly and moth wings, and similar objects should be tested to determine whether they ought to be mounted dry or in balsam. Sometimes a balsam mount will suppress too much detail, while at other times it improves the detail. A simple test for determining which is better is to examine the specimen first in air, and then place it in turpentine under a cover glass. If the dry mount looks better, you can remove the turpentine merely by blotting, or by washing with xylol and drying. If, on the other hand, the specimen shows up better in the turpentine, it means that a balsam mount is preferable. Because balsam and turpentine mix perfectly, you can complete the mount merely by adding balsam.

When mounting scales or hairs in balsam, make sure that they are dry. Gentle heating over a flame or electric lamp will accomplish this. Put the specimen in a drop of xylol or turpentine, in the center of a slide, and then add a drop or two of balsam.

FOR dry mounts, you can use simple slides made by cutting a circular or square hole, slightly smaller than a cover glass, in a sheet of thin cardboard or plywood measuring one by three inches, and pasting the strip to a solid piece of cardboard. The circular cell should be in the exact center. If desirable, paint the bottom of the cell with black India ink. Then cement the specimen in position with balsam, and over it place a clean cover glass, its edges cemented in place with balsam.

There are several variations to this method. Some specimens, such as butterfly-wing scales, can be placed loosely in the cell without cementing. Very delicate specimens can be fastened by coating the bottom (Continued on page 130)

DISCOVERY IN EAST BOSTON

Robert deMinico, who is connected with a big Boston shoe plant, loves to make things of his homeland's Carrara marble in his spare time...

"I think, files should help me cut designs in the marble," he says, "but all over the world I try to find a file that will cut..."



"I work in Milan, in Paris... I cannot find... every file I try just refuse the work... it disgusts... I am ready to give up files..."



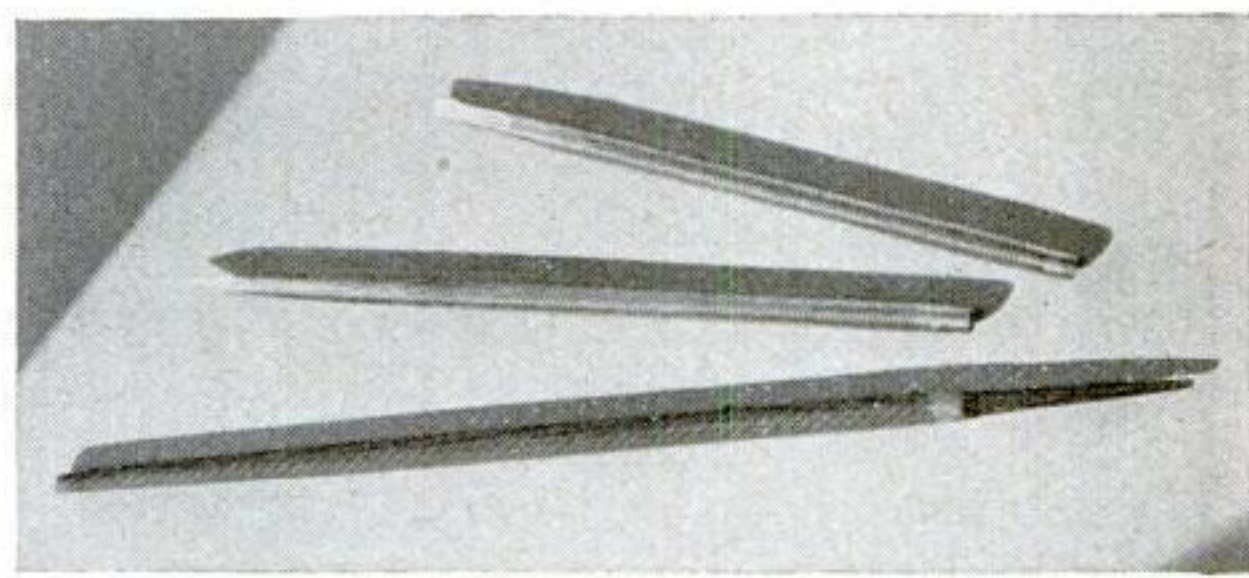
"Then one day I try the Nicholson... aaah! She cuts through the Carrara marble like butter... I think, now I have something..."



"You see, every touch so easy, so true-cutting... I tell my wife, from now on Nicholson Files are my files. Such steel!"



"From them I make the fine, sharp chisels to use in my work... that steel holds the edge!"

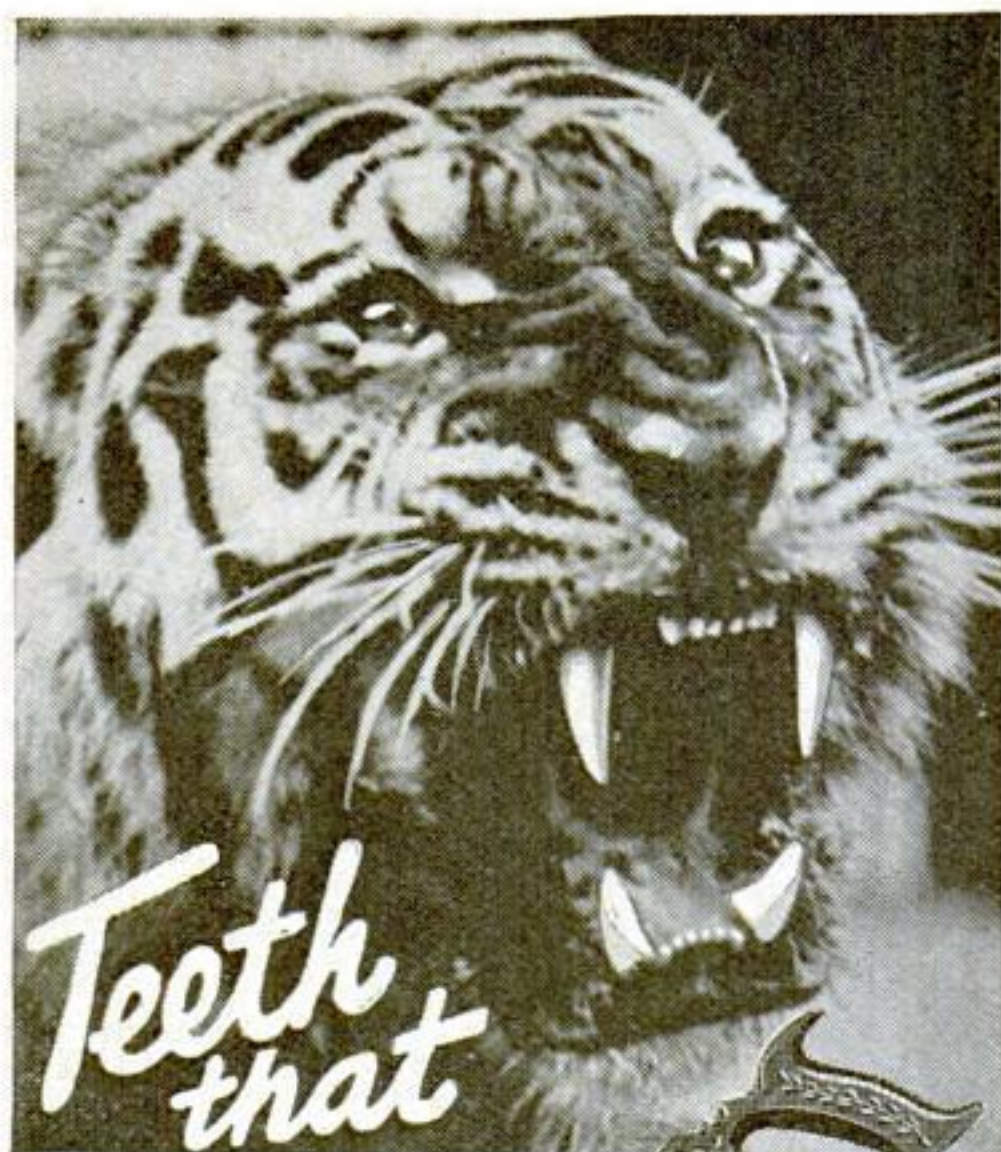


"Such teeth! See the touches of beauty I give the marble... even the fine details... so easy!" Take it from Mr. deMinico, whether you're boss of a home workshop or a big plant, fine Nicholson steel and new Nicholson tooth construction promise faster cutting, better work, longer life. Your hardware and mill supply dealers can meet your needs. Nicholson File Co., Providence, R. I., U. S. A.



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E. C. ATKINS & COMPANY
428 S. Illinois St., Indianapolis, Ind.

Studying Insect Hairs Under a Microscope

(Continued from page 129)

of the cell with a very thin film of balsam, and then making the film tacky with a drop of xylol just before introducing the specimen. In case you want to have the top of the cell so that it can be uncovered for close examination, you can omit the cover glass and fold a strip of cellulose wrapping material around the slide when it is stored away, to keep out dust.

If you desire to mount an entire insect skeleton or part of it (such as a honey-bee leg), and find that the specimen is too opaque, try the following procedure: Soak for a week or so in a ten-percent solution of potassium hydroxide (ten grams of hydroxide to ninety cubic centimeters of water). A similar solution of ordinary lye can be used. This dissolves the softer tissues, leaving the chitinous skeleton and external details. If the horny chitin is not yet transparent enough, you can bleach it further, after washing thoroughly to remove the alkali, in hydrogen peroxide. Dehydrate by placing for a short time in dioxan, or by running it through a series of alcohol baths, and then mount in balsam. This method is used for specimens to be examined by transmitted light.

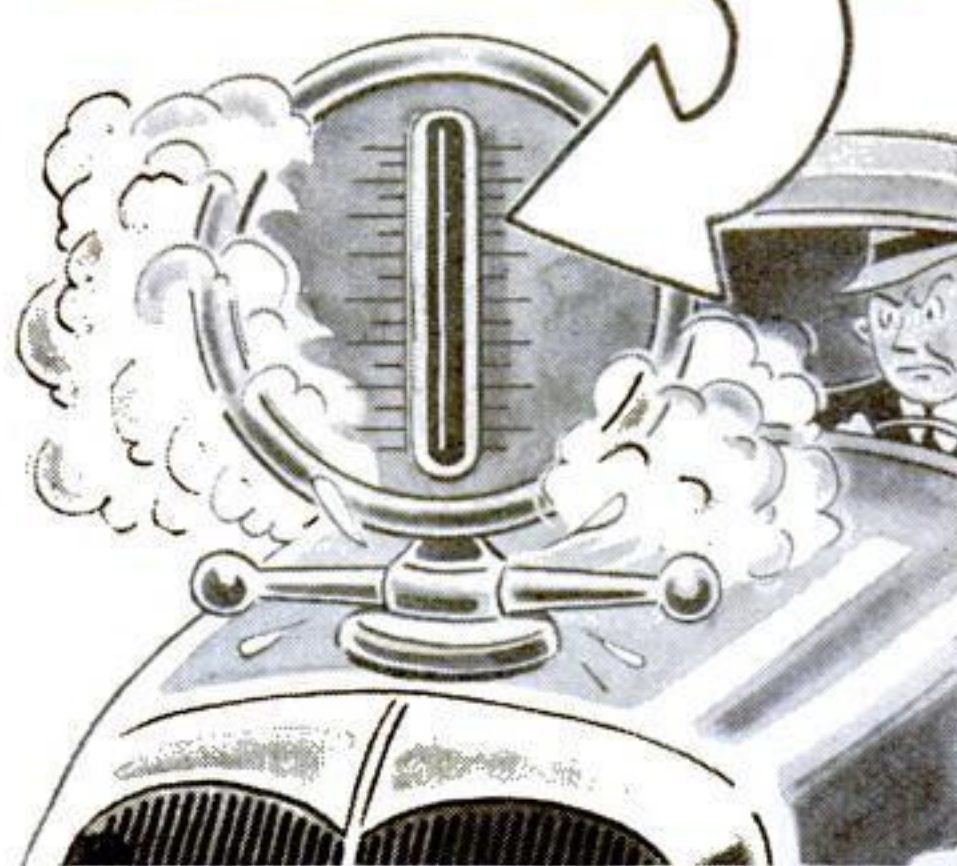
EXCELLENT specimens of hairs and other external appendages frequently can be prepared from the shed skins of insects and similar animals. Some larvae shed their skins several times. The spider, which is not an insect but an arachnid, sheds its outgrown skin and leaves it in its web. Be sure that the shed skin is dry, then moisten it with xylol or turpentine and mount in balsam, taking care to exclude all air bubbles.

Insect hairs and scales are not the easiest things to photograph through the microscope. They have a habit of being in such a position that they do not lie in the plane of focus of the objective. The only remedy is to search the slide until suitably positioned ones are found. If colored scales are being photographed, they generally show better if a color filter that renders them with considerable contrast is placed between the light source and the microscope. Most insect hairs are of a yellowish color. They are recorded with greatest detail in yellow or orange light, and with greatest contrast in blue light. Your plate or film must, of course, be sensitive to the colors of light used.

Microphone Hears Grubs Boring Through Wood

SO SENSITIVE that it will pick up the sounds produced by a grub as it eats its way through wood, a new electric ear is being used to detect the presence of borers in timber. The vibrations produced by the grubs are amplified a million times through a series of vacuum tubes. A muffled, intermittent rattle in a loudspeaker connected to the amplifying system betrays the presence of the insects. The sound made by the borers is so feeble that trouble is experienced with outside noises transmitted through the wood, so it is necessary to place the specimens of timber to be tested in a special soundproof box before the tests can be made.

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CLEAN OUT WITH
SANI-FLUSH!**



BEWARE of a car that overheats! Power is being lost. The motor becomes sluggish. Extra strain is being put on the motor and you may run up a fat repair bill.

Save worry, power and expense. Just put 10 cents' worth of Sani-Flush in the radiator (directions are on the can). Run the motor. Drain, flush and refill with clean water.

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WINCHESTER
TRADE MARK

Inlaid Signs Made on Scroll Saw

GLOSSY, durable signs in any alphabet, script, or trade-mark design may be made with a scroll saw. To conserve material and time, it is best to make these signs in duplicate except that the colors of the background and letters are reversed.

To construct two signs (more may be cut at once by adding extra material to the pad), choose two sheets of cast-resin plastic material in contrasting colors $\frac{1}{2}$ in. larger each way than the size of the finished piece. Fasten these sheets together in the $\frac{1}{4}$ -in. margin with drive screws. Draw the sign on a sheet of paper and fasten this to the top sheet with rubber cement. With a No. 55 drill bit (a small needle with half of the eye cut off is satisfactory), make a hole in a corner of each letter, and proceed to cut out as you would a marquetry picture, using an 000 jeweler's blade or a No. 33 puzzle blade. Cut the center parts of all A's, B's, D's, and the like before the letter itself is sawed out. Save all pieces.

All parts are then assembled on a board upside down. If the sign is to be used outside, $\frac{1}{4}$ -in. thick plastic should be chosen as the backing, otherwise three-ply gum veneer will serve just as well. The backing and the letters are then liberally coated with the special cement sold for plastics. Add alcohol when mixing this cement, six parts to a hundred, to make it set slower. Lay the backing on the letters and carefully turn the sign over, keeping it between the two boards. Sections of the waste strip



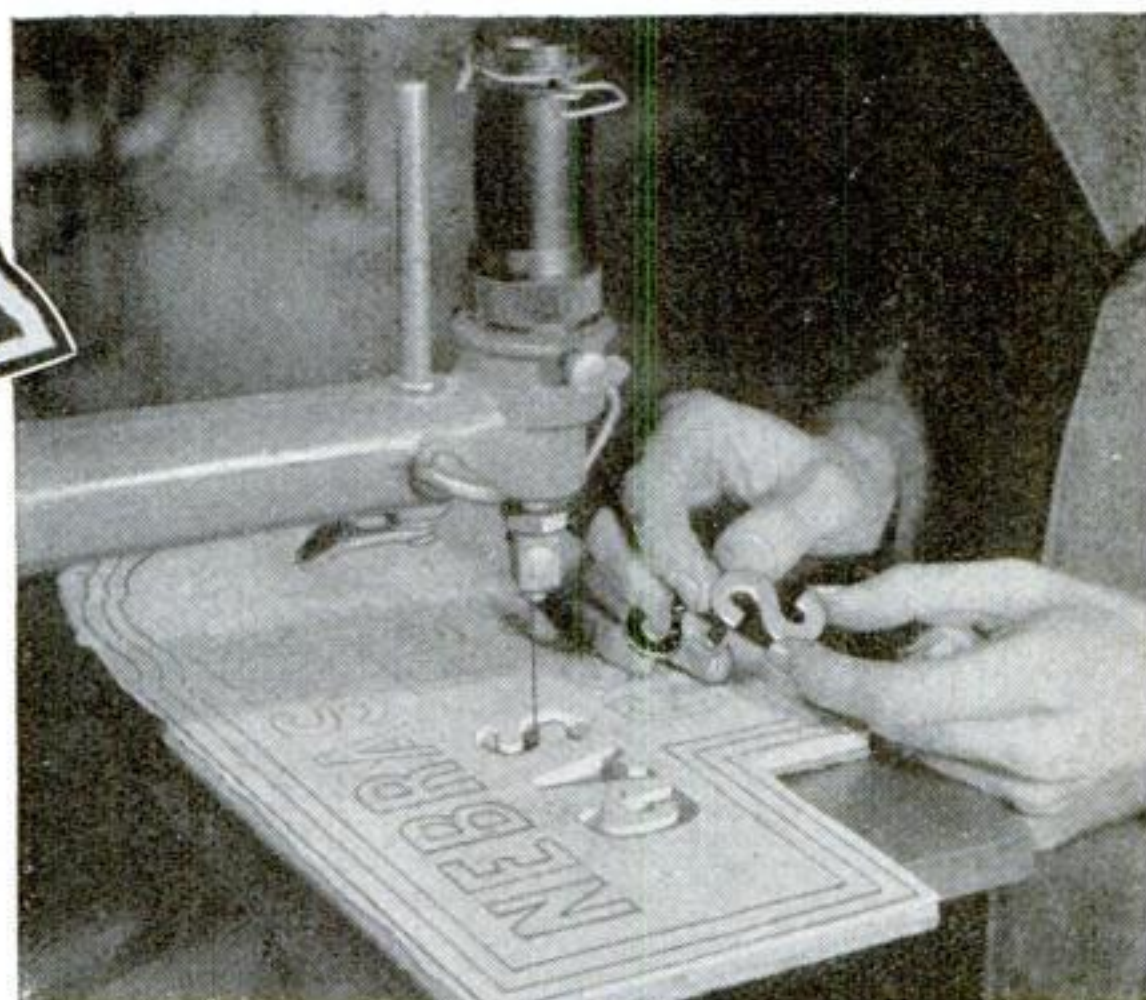
A brilliant and practically everlasting sign cut from sheets of cast-resin plastic material. The two colors are jig-sawed at once

cut with the letters are then tacked in a single thickness along the edge to prevent slipping, and the whole is placed under weights or in a veneer press to dry. Pad it well with newspapers and a rug.

After removing it from the press, cut the edge to shape on the jig saw and sand the face of the sign, beginning with No. 1 and proceeding to No. 5/0 garnet paper, always on a block. Clean thoroughly with a stiff brush, and work cement into any saw cuts.

The buffing and polishing can be done by hand, but it is far easier and quicker to use a motor-driven rag buffing wheel. Use the compounds sold for this purpose. The back may be stained and varnished, or painted.

Wood veneers may be substituted for sheet plastics in making signs to be used indoors.—L. L.



The sawed-out parts are assembled into two signs, the colors, of course, being reversed

"I'D RATHER BE YOUR WIFE THAN YOUR WIDOW."

PLEASE PUT THIS BLOW-OUT PROTECTION ON OUR CAR"

WHETHER you're married or single—whether or not you've ever had a blow-out, don't blind yourself to these facts.

Thousands of motorists are killed or injured—thousands of dollars are spent for repairs, doctor and hospital bills every year when blow-outs throw cars out of control. Every day *somewhere, some one* is headed for a costly or fatal blow-out accident.

Many of these blow-outs that you hear and read about are due to the heat generated *inside* of all tires by today's higher driving speeds. To provide you, and *everyone* who rides with you, with real blow-out protection, every new Goodrich Silvertown Tire is built with the Life-Saver

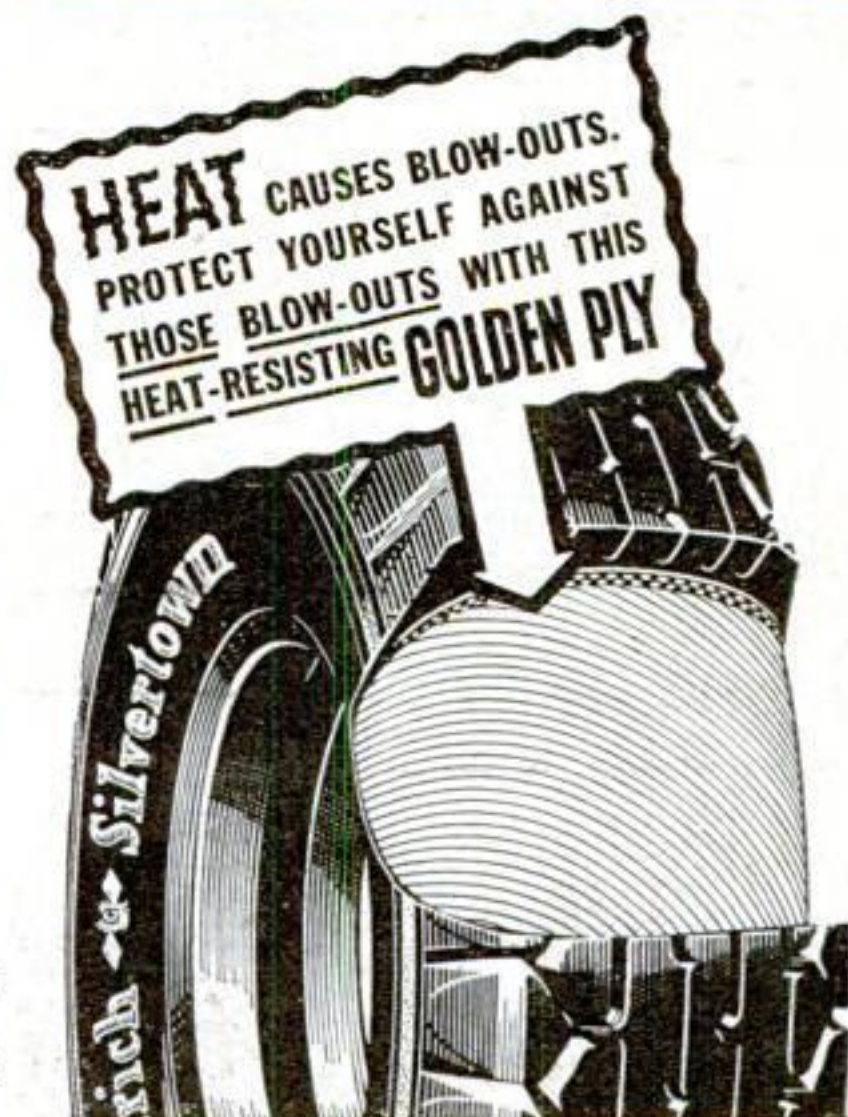
Golden Ply. This Goodrich invention is a layer of special rubber and full-floating cords, scientifically treated to resist *internal tire heat*. By resisting this heat, the Golden Ply gives you *real* protection against these high-speed blow-outs.

No tire gives you *Golden Ply* blow-out protection unless it's a Goodrich Silvertown. And don't forget this life-saving tire costs *much less* than other super-quality tires.

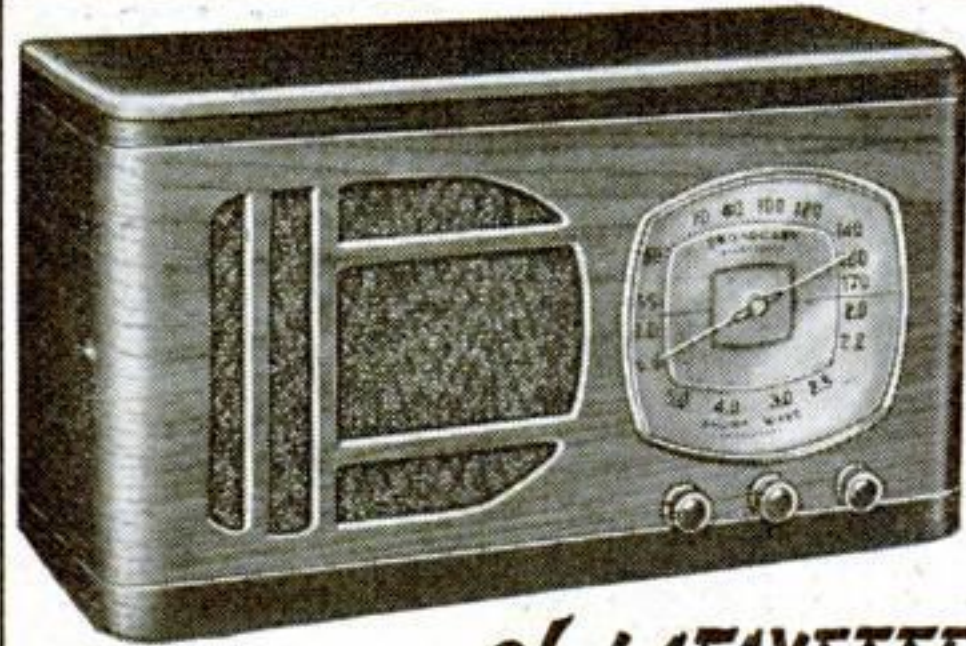
Thousands of motorists have found that Silvertowns *below* mean safety *above*. For your own peace of mind, for the protection of your family and friends, stop at any Goodrich Silvertown Store or Goodrich Dealer for a set of these life-saving tires. *It's better to be safe than sorry!*

Goodrich SAFETY Silvertown

The Only Tire With Golden Ply Blow-Out Protection



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RADIO SEND FOR IT!



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Repairing the Horn Handle of a Hunting Knife

TO REPAIR the horn handle of a hunting knife, first clean the exposed metal under the break; or, if the horn is not broken to the metal, scrape the damaged part to remove all grease. Then clamp the handle to hold the horn tightly in place. If the handle has pulled away, flow thick shellac or some metal cement under the bone before clamping. If one of the rivets is loose, clear away a little of the bone so that there is some space around the rivet.

Flow a rather thin layer of plastic composition wood over the bare spots and work it in very thoroughly. When this is dry, put on another layer, and keep on adding layers till the plastic is a little above the level of the horn. After the last coat is hard, trim the surface smooth with file, knife, and sandpaper; then cut or file indentations to match the horn.

The wood composition will be about the color of the white part of the horn. The brown markings can be put on with varnish stain. After this has dried thoroughly, a little wax will give it a polish, and soon you can scarcely tell where the patch is.—C. A. HICKMAN.

How to Whittle Jumbo

(Continued from page 100)

tusks. The rest of the body will come right almost automatically when you round it up. Cut carefully around the feet, because they flare outward across the grain, and separate them by cutting a deep V-notch.

Do not quite cut through between the outer end of the trunk and the head, but make it look as if you had. In the center of the hump that marks Jumbo's eye, lay out a slanting oval, as in Fig. 5, and cut a V-notch all around it until it can be shaped into an eyeball. Curve the wood outside it to form the heavy, pouchy eyelids.

A very small, sharp gouge, veiner, or V-carving tool is desirable for marking the wrinkles, and in case you do not own one, a suitable tool point and handle are included with the construction kit.

Jumbo can be painted white, gray, or black. The finished elephant shown in one photograph was painted a light greenish gray, then dark brown was brushed over lightly and rubbed off the surface. A touch of black on Jumbo's eye, a little red about the mouth and trunk end, and white or ivory on the tusks, and he is complete.

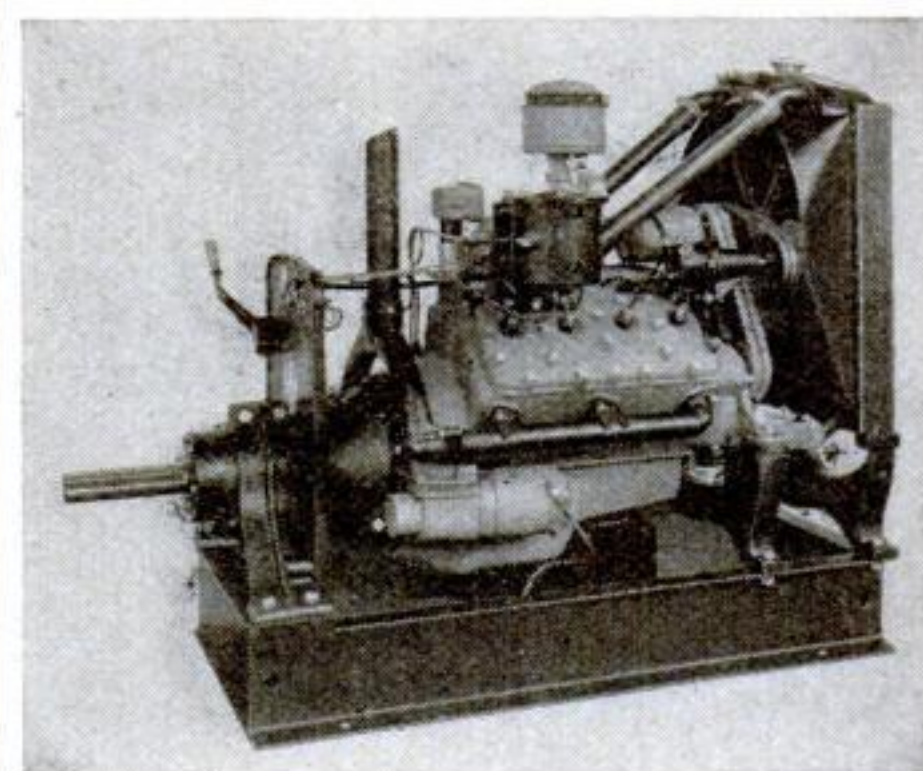
There are dozens of ways you can use Jumbo. He makes an attractive desk or mantelpiece ornament, either as he is or mounted on a base. Other uses are as a paper weight or as a decoration on an inkstand, pen tray, pin tray, pipe stand, ash tray, book ends.

Popular Science Monthly
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I want to whittle Jumbo, so send me your new Copycraft Kit No. 11, including an actual model to copy, a sawed-out block of selected white pine, a small V-point tool for carving the wrinkles, and the necessary paint. I enclose \$1.50.

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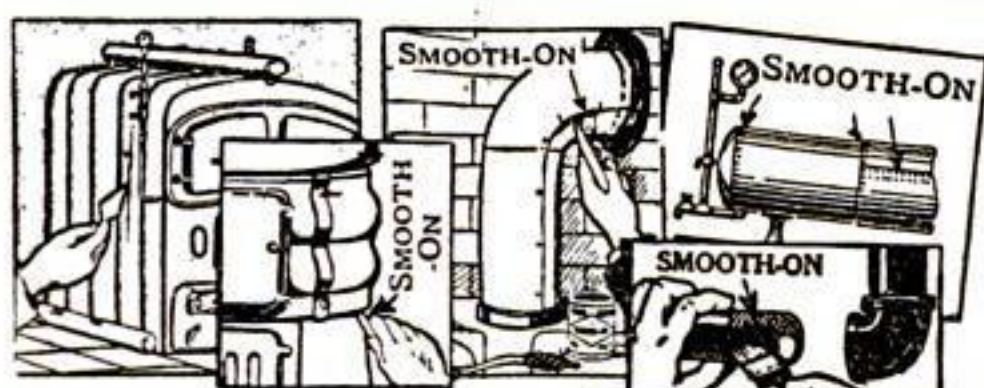
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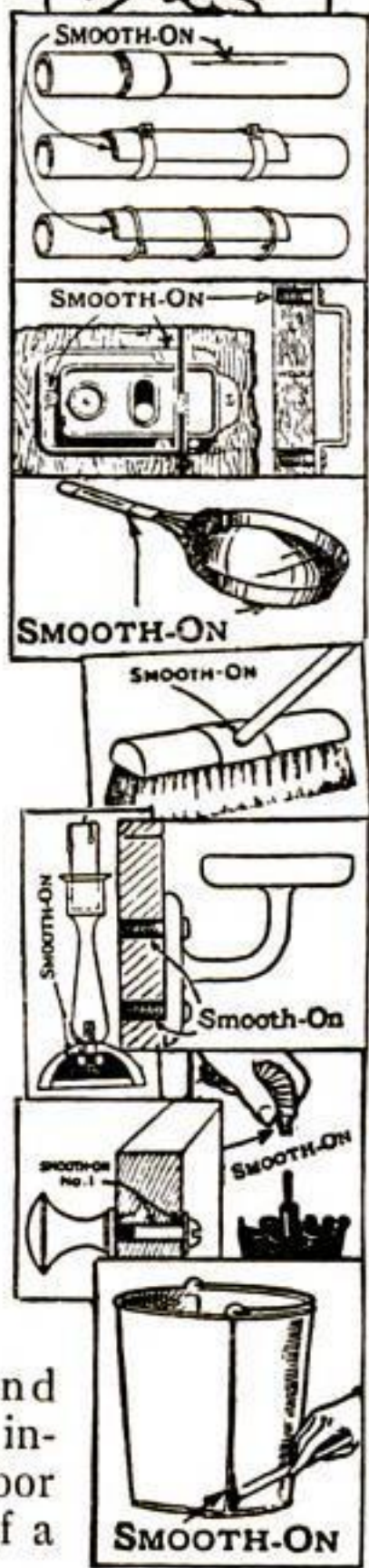
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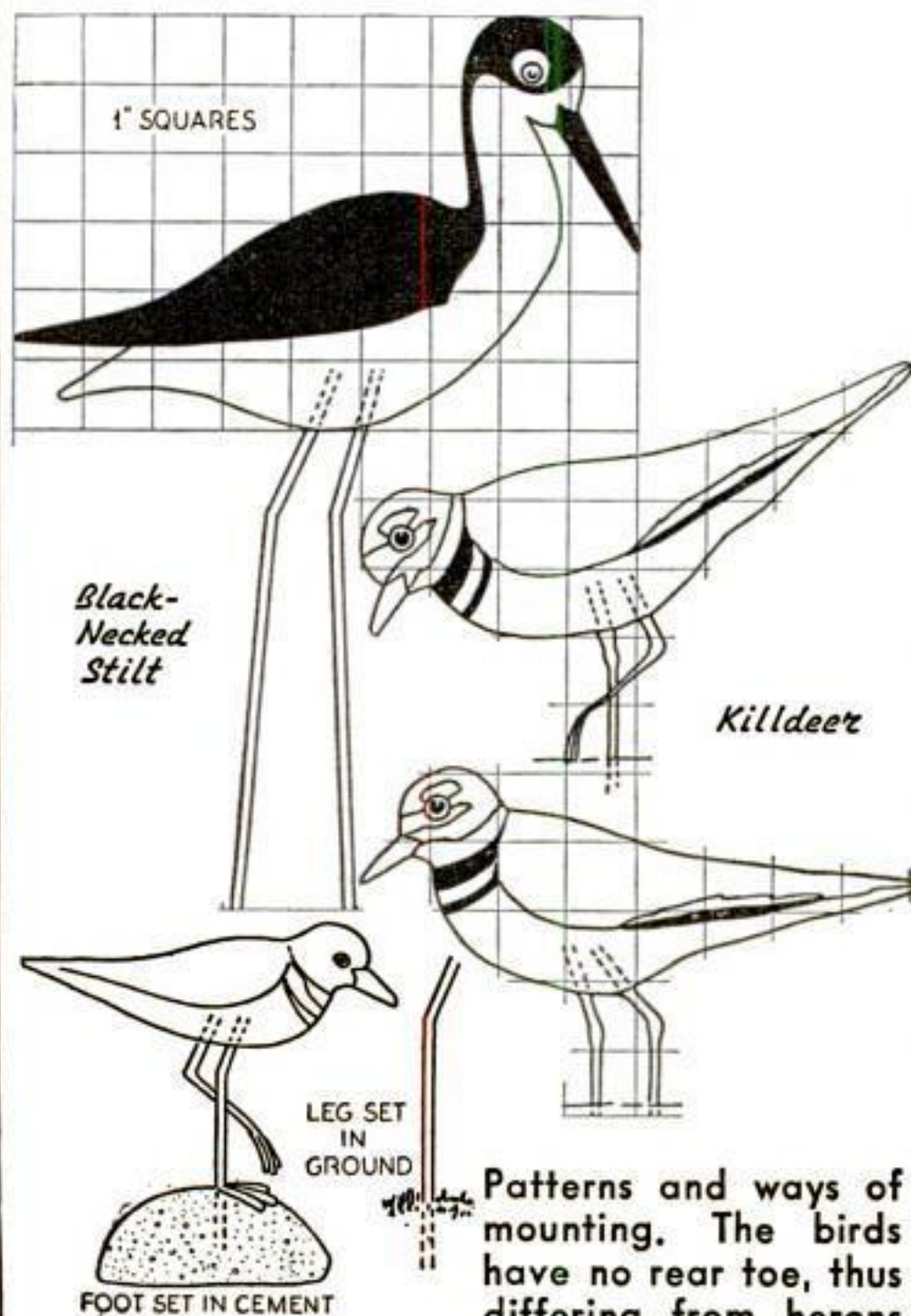
Wooden Wading Birds FOR A GARDEN POOL

FOR a small garden pool, especially if it is close to the sidewalk, jig-sawed wading birds such as the killdeer and the black-necked stilt give just the right touch. Two patterns of the killdeer and one of the stilt are given below, but you can make the second pose of the stilt, as shown at the head of the column, by merely tipping up its head and bill. The angle to which the legs are bent can also be altered to change the pose as desired.

Cut the shapes from 1/2-in. wood. Use heavy wire for the legs, allowing a sufficient length at the lower ends for fastening the birds in their places. The legs of the stilt may be pushed into the ground at the edge of the pool or imbedded in a block of cement or a log of wood. If you solder pieces of wire to the birds' legs to simulate toes, note that neither of these birds has a toe at the back.

The black-necked stilt is black and white with red eyes and legs. A spot of white sets off each eye. The more familiar killdeer is rather quietly dressed with upper parts of grayish olive and white lower parts. The white space includes part of his face and a ring around his neck. There are two black rings at his neck, and a narrow strip of black and of white mark the line of the bird's wing.—HAZEL F. SHOWALTER.

Patterns for larger waders were given in a previous article (P.S.M., July '37, p. 75).



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from the heel there is a strap with two turns around the mast and an eye for the sprit end. The sprit is just a straight stick tapered to both ends.

The oars are easily made from 1/4-in. square sticks of birch with plane, spokeshave, and file. It will be noted that the blades and handles are all of about the same dimensions, but that the looms vary in length; each is marked with stripes to insure its readily being used at the right position. No. 1 is the forward oar. The steering oar has a longer blade and a short cross handle. These and the spars may be lightly varnished.

SOMETIMES, at close quarters, paddles were used in place of the oars, so there are five of these. They are just thin pieces of wood let into saw cuts in the handles, painted white. They lie under the thwarts.

Most important, of course, are the toggle harpoons, more often called "irons." There are two "ready" and three "spare." This is how I made mine: Heat the eye of a large No. 3 sewing needle, hammer it a bit flat, and enlarge the end of the eye to take a small pin. Get a piece of soft iron rod (I used a can-opening key), heat it, and hammer it to the required thickness with sufficient width to make the harpoon head. Saw and file the long curved edge; cut a slot in this wide enough to take the needle eye; cut the other edges, and file the sides round, to shape. The slot leaves a split point, so put a piece of hardwood in the required part of the slot, tap the points together; fill in the gap with solder, and file

(Continued from page 97)

smooth. Drill a hole for a small pin, set the needle and pin in, snip off the end, and rivet, being careful not to close the slot too tight on the needle eye.

The other end of the shaft should have a cone-shaped socket for the handle. Instead, I set the point of the needle into the wood and gave the latter a short taper to obtain the same appearance. This tapered part is served (wound) with very thin cord. The handle is just a straight stick, 5 ft. long, actual size. The lanyard has an eye splice just large enough to take a round turn around the socket; it then lies along the handle, to which it is fastened with two seizings, the upper one on the tucks of another eye splice. To this latter the whale line is hitched.

MADE the two "ready" irons with swivel points, but the spares are dummies. It is the habit to put wooden covers over the blades of the spare irons and lances, so I made only the covers and inserted the eyes of the needles.

I made one real lance and two dummies. The real one consists of two pieces of tin soldered on the end of a piece of wire and filed to sharp edges. The sockets, handles, and lanyards are like those for the irons, except that the lanyards should come to the ends of the handles.

The whale lines, some 300 fathoms long, are very neatly coiled in two tubs. The real lines are 3/4 in. diameter, and 18-thread fishlines will represent them. If dyed a Manila rope color, they look better. The tubs can be made with

staves, but I cut mine out of soft wood and scooped out the inside only deep enough to take two layers of rope. The long line will have enough loose end to go around the loggerhead, to leave some slack in the box, and to pass over the bow chock and to the harpoon. Its lower end will also be out of the tub and eye-spliced to the upper end of the short line. Each tub had iron hoops, which may be strips of black paper, and lanyards to tie them to the thwarts. I stained these and similar parts to look like oak, but they may be painted.

The second iron has a line three fathoms (18 ft.) long, actual size, fastened with a running bowline to the first.

The other round pieces were also cut from solid wood and hollowed where necessary. The drug, or drag, is for fastening to the end of the whale line if it has to be let go; it has a cross lanyard spliced across the bottom. The bucket has a stave left long on either side and bored for a rope handle with knots in its ends.

The piggin, or bailer, has one long stave for a handle. The lantern keg contains matches, bread, tobacco, signals, and the like. It has a lanyard to hang it under the cuddy board. The water keg has filling and emptying plugs.

There is a little compass in a box, held by rabbetted cleats under the after thwart. The grapnel is made of four pieces of No. 20 wire, soldered together and filed square for the shank, with the ends curved around and the points hammered flat for flukes. There is a hole and ring at the other end.

(TO BE CONCLUDED)

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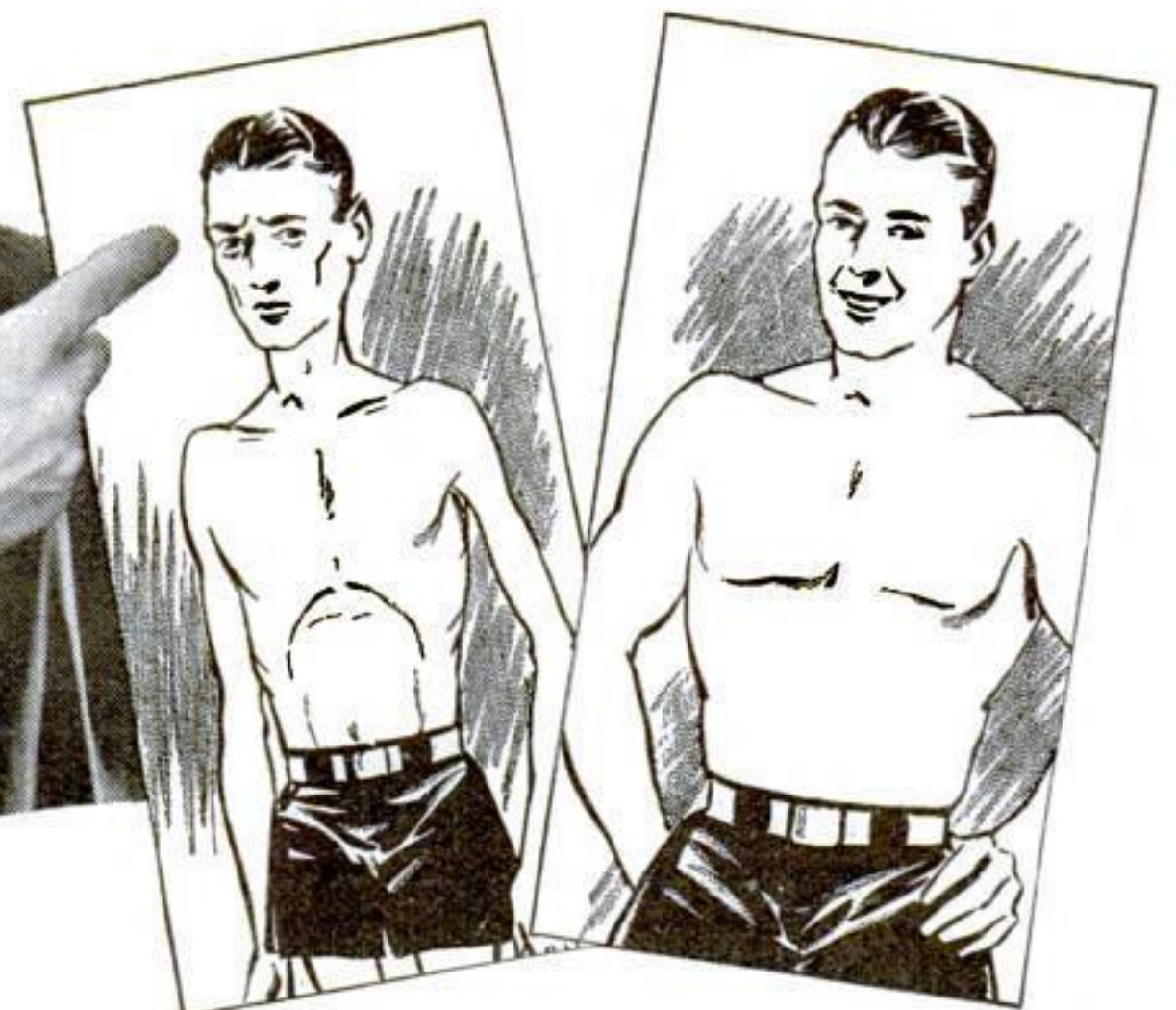
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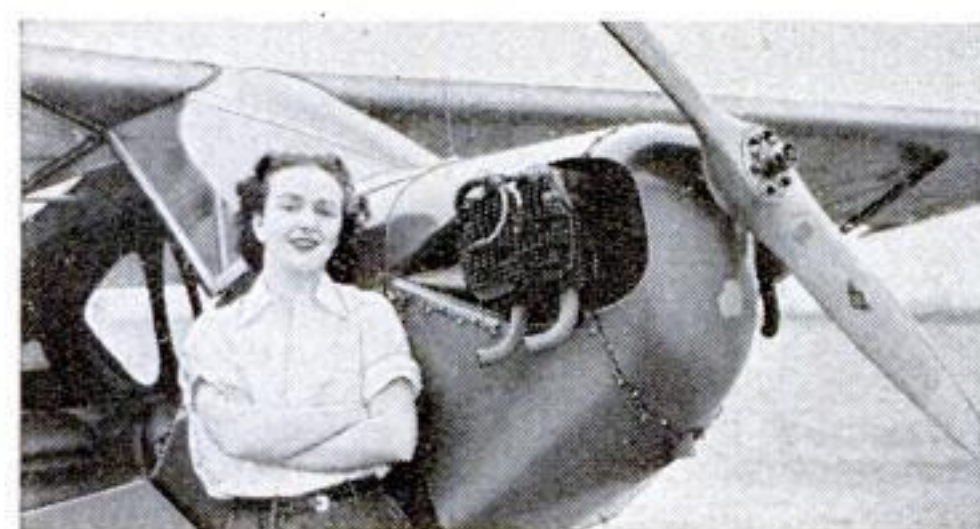
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Exploring New Worlds Beneath the Sea

(Continued from page 31)

along the coast of southern Florida, Dr. Beebe points out, science would establish observation posts for studying 10,000 forms of life about which we know comparatively little.

In Chesapeake Bay, Prof. Reginald Truitt and his associates at the Chesapeake Biological Laboratory have been carrying on submarine explorations to learn more about how fish live their watery lives far below the surface. They are using a six-foot steel cylinder with heavy glass windows in the side and top. This cylinder, called a "bentharium," from the Greek meaning "a room at the bottom of the sea," is lowered through a well in a floating raft and carries two observers. In it, the scientists have made scores of trips to the oyster beds and the grassy bottom of the bay where marine life is most abundant. They have descended at all hours of the day and night, near and far from shore, and even during storms. Not long ago, they went down before dawn to see how sunrise looks to a fish!

THE colorful show they witnessed gives us a hint of what lies ahead for us when sea-bottom trips become common. The bentharium slid into the black depths before the first streak of dawn. Watching through the windows, the men saw the water around them change from black to blue to pink to orange-red and finally to the translucent green which is its daylight hue. Once, they looked upward through the top window and saw the most spectacular display of all. Great, fiery red balls of light were hurtling downward through the orange water. The sun had just cleared the horizon and the facets of the running waves were reflecting the image downward.

One important phase of submarine exploration is the study of the ocean bottom itself. In the rock strata of these submerged plains and valleys and mountain ranges will be found the keys to age-old geological puzzles. For example, scientists are now divided into two camps on the question of the formation of the continents. One school holds that they were once connected by land bridges, long since submerged; another that they are like cakes of ice floating on water, slowly drifting from place to place on the molten material of the inner earth. Eventually, material brought to the surface from submarine mountain ranges may tell us which hypothesis is correct. If the ranges once formed land bridges, rock samples will contain fossils peculiar to above-water areas.

RECENTLY, Dr. Charles Piggott, of the Carnegie Institution, in Washington, D.C., announced a new aid for obtaining geological secrets from the ocean floor. This is an immense hollow punch, fired straight down into the ocean by means of explosives and then hauled up again with a cylinder of rock from the sea bed. By this method, the scientist has brought to the surface from a depth of 7,200 feet cores of rock eight feet long.

Another interesting piece of news in the realm of ocean-bottom exploring has come by radio from the north pole. Members of a Russian expedition recently took soundings and found the water to be 14,400 feet deep at the top of the globe. The sub- (Continued on page 136)

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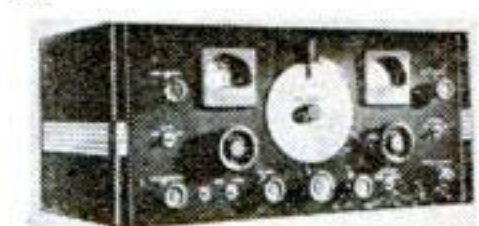
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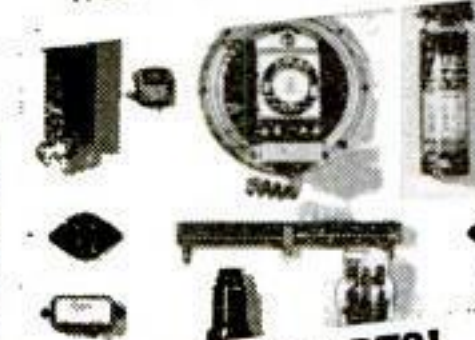
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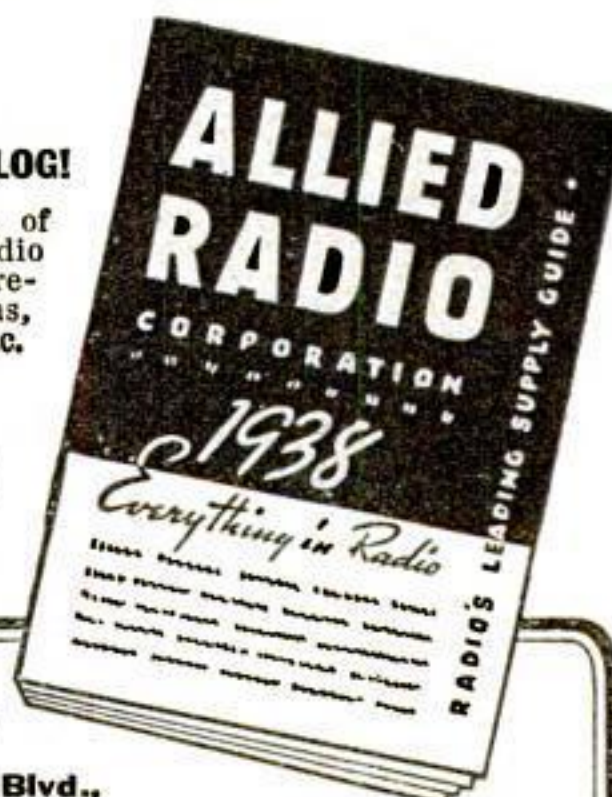
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Exploring New Worlds Beneath the Sea

(Continued from page 135)

marine floor, at this point, is formed of gray-brown silt.

Thousands of miles away, in the warm waters of the Mediterranean, amateurs have taken up submarine exploring as an exciting hobby. Led by Jean Painlevé, son of the former French premier, "under-sea clubs" are flourishing. Several hundred members don special masks and strap little tanks of compressed air to their shoulders for fifteen-minute trips below the waves. With three-pronged spears and pneumatic rifles, they hunt fish in watery jungles a dozen feet or more beneath the surface.

A RECENT development in the sport has been searching for submerged cities along the seacoast. One enthusiast, not long ago, recovered rare Roman pottery from a village which long ago had sunk into the sea off the coast of southern France. These amateur adventurers can descend to a depth of from fifteen to twenty feet with face masks and air tanks as their only equipment. With a heavy helmet fitted over his head, Beebe has reached sixty-foot depths. This, however, is about the limit for a man without a complete diving suit.

In California, not long ago, a one-man "crawler" submarine received its initial tests. This undersea midget looks like a small boiler mounted on endless treads. The operator, lying flat within the body and looking out through a window in the front of the metal capsule, guides the craft as it rolls along. Electric motors propel it, the power coming down through cables from the surface. With the help of this bizarre combination of submarine and tractor, the inventor hopes to locate a gold-laden river steamer which sank years ago in San Francisco Bay.

When Dr. Beebe made his first deep descent in the original bathysphere, he reported a curious discovery. Life in the depths of the ocean, he found, has zones of abundance, like the layers of a cake. Another more recent discovery made by this same scientist concerns the effect produced by ultra-violet light on salt-water fish.

USING a special ultra-violet searchlight, he shot invisible beams down into the water from the end of a wharf. His nets drew up an increasing number of fish. They were congregating at the spot. He found they swam along the path of the beams as though charmed by them. In a number of instances, marine creatures fluoresced, glowing with brilliant colors just as do certain minerals when placed in ultra-violet light. During the present season, at his Bermuda station, the scientist has been carrying on further experiments to determine why fish are attracted by the "black light."

This is still a mystery—one of the host of mysteries connected with the world of the sea. The gold of the *Lusitania* and other treasure ships that strew the ocean floor is but one of the incentives to submarine exploration. Strange sights and scientific discoveries await the pioneers. Between the ocean floor and roof, as Beebe has said, stretch, in truth, the last horizons of adventure.



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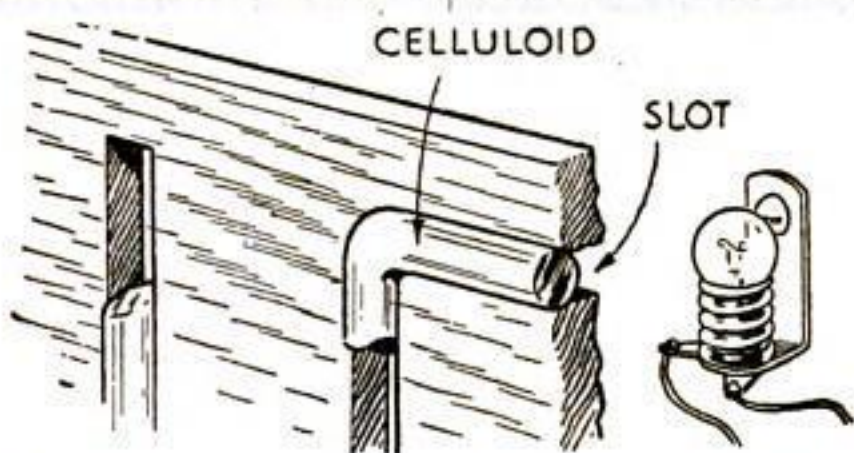
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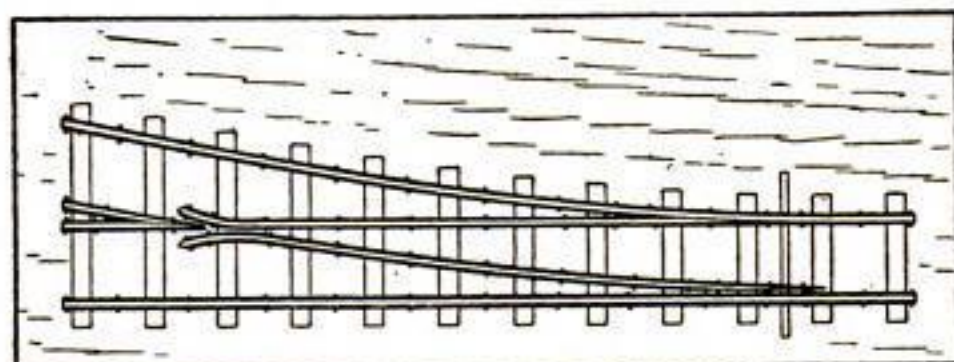
Making "Neon" Signs for Model Railway



Translucent colored celluloid about $\frac{1}{8}$ in. in diameter is set in the jig-sawed slots

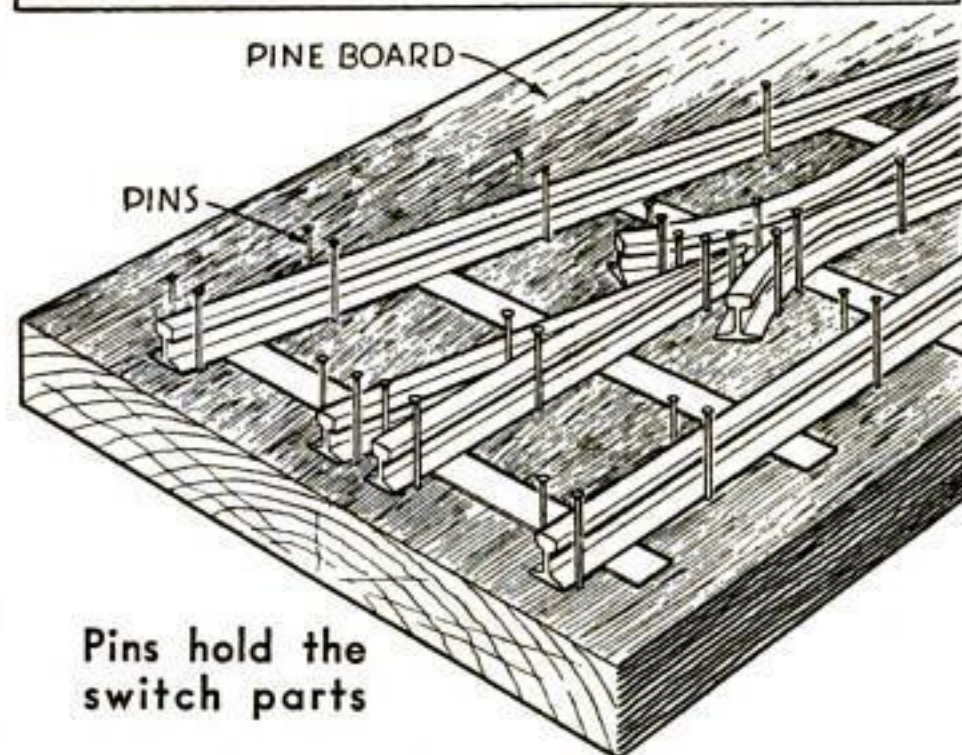
MINIATURE signs resembling the neon type may easily be made for use in model railway layouts. Cut strips about $\frac{1}{8}$ in. wide from translucent colored celluloid such as may be found in old toothbrush handles. File the strips round, buff to a polish, and soften in hot water so they can be bent to fit into slots about $\frac{3}{32}$ in. wide jig-sawed in the signboard as shown. If a light is placed behind the sign, the celluloid letters will look like tiny neon tubes.—H. W. KLOTZ.

A Jig for Assembling Miniature Switches



PINE BOARD

PINS



Pins hold the switch parts

PINS driven into a pine board may be used to form a jig for soldering the parts of small-gauge model railway switches to the tin ties. The switch parts are set in place, then the ties are slipped under them.

For larger gauges with wooden ties, the same method may be used, provided spacers are made to hold the ties the right distance apart. The pin heads should be clipped off.

I use a pair of jigs, one right-hand, the other left-hand. Guard rails are added later.—LOREN BUTTS.

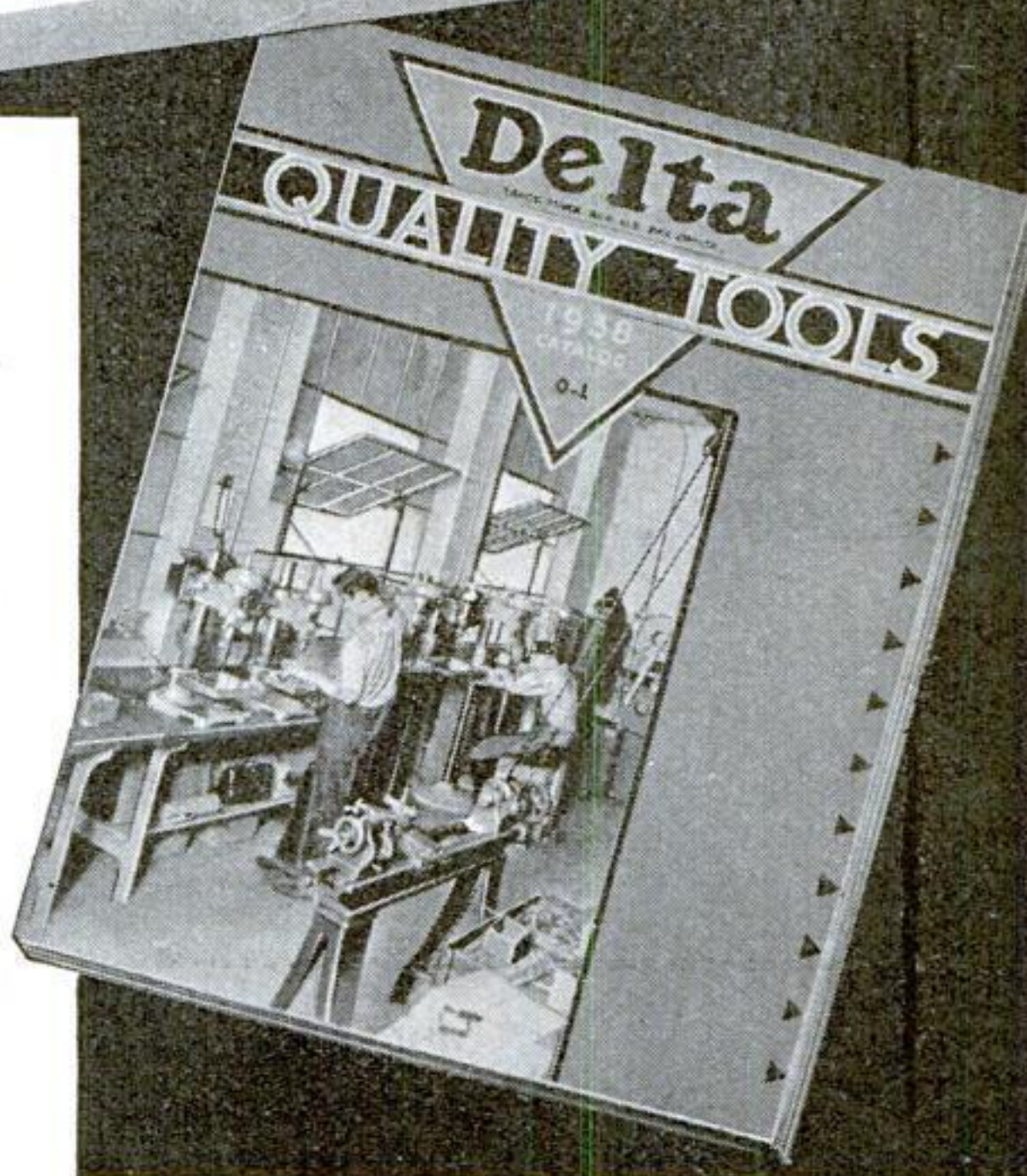
Discarded Wire Coat Hangers Aid in Model Railway Work

MANY model railway accessories such as signal towers, lamp-posts, high-tension towers, and overhead trolley-wire hangers may be made, at least in part, by using common wire coat hangers.

NEW 1938 CATALOG of DELTA Quality Tools

The 1938 Catalog of Delta Tools will be out soon. Eagerly awaited by motor driven tool owners the world over, this guide book to modern tools tells "What's New in Tools," the latest improvements and refinements in motor-driven units and information about the newest tool accessories.

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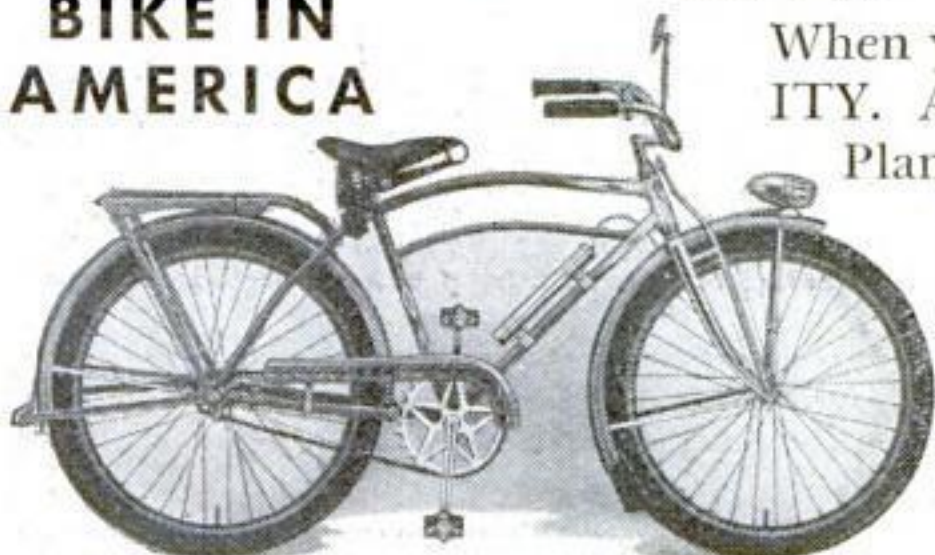
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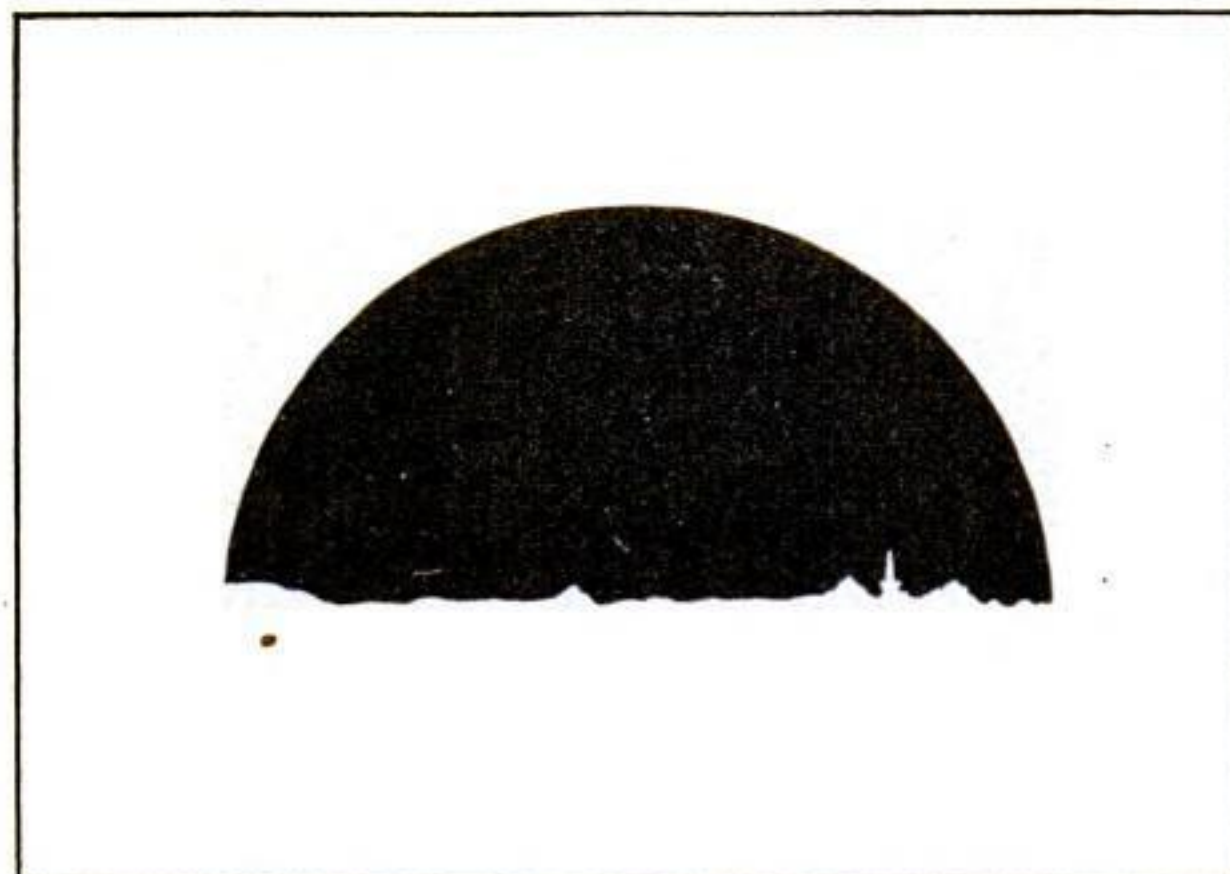
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Address Canadian inquiries to Hough & Kohler, Ltd., Toronto

The horizon mask that gives the projected images the appearance of being above the earth. It should be photographed half size and the negative mounted on a square of glass



Making a Tom Thumb Planetarium

(Continued from page 79)

slides and slide-rotating mechanism are complete, as you then can center the brightest spot in the lamp directly in the axis of the lens system, insuring an evenly illuminated screen.

To give the projected star pictures an illusion of realism, an artificial horizon is provided in the form of a mask. This is the sixth of the drawings that are provided for you to photograph. The negative, which will show a clear opening surrounded by a black area, is cemented to a square film of glass with the film side exposed. This piece of glass is fastened to a cardboard mask holder arranged to slide up and down in grooves.

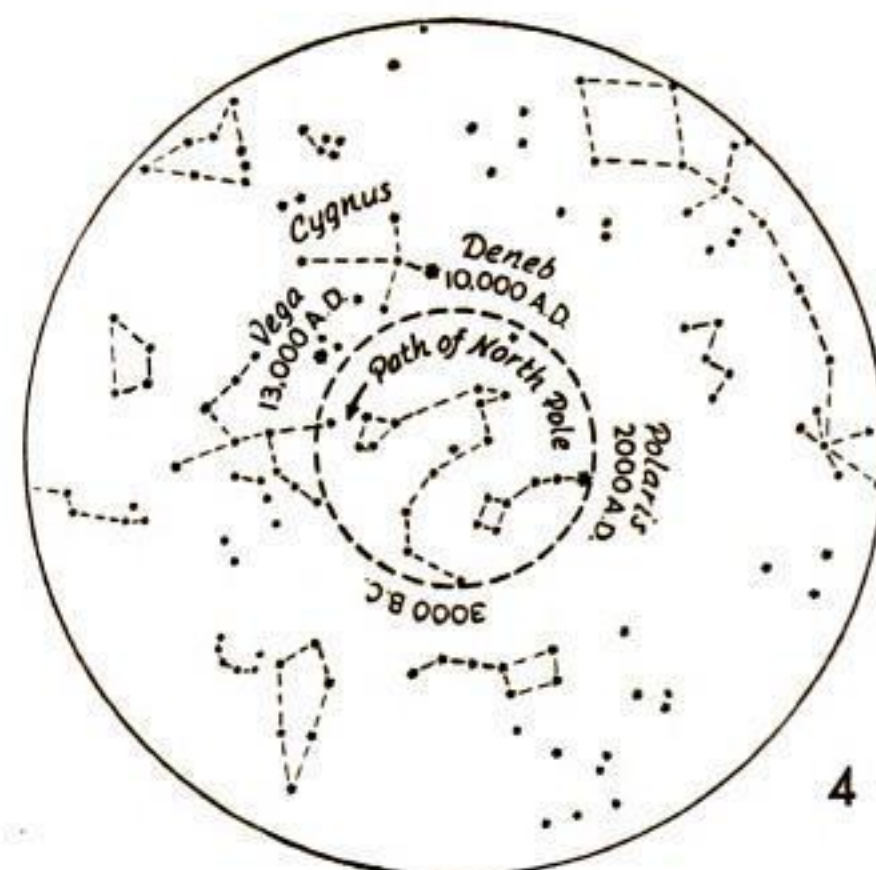
The film side of the horizon mask should come into smooth contact with the surface of the circular slides; this close contact is necessary so that both the rotating slide and the mask can be brought into sharp focus on the screen.

From the mask a strip of stiff cardboard extends upward beyond the top of the lamp house. It acts as a handle, enabling you to frame the picture on the screen. It also is used to raise and lower the horizon during the imaginary voyage from the pole to the equator. A few pencil marks at the edge of the cardboard strip will enable you to put the slide in either of the two standard positions in which the picture is properly framed for the various slides.

The projection lens used in the model illustrated is made from two ten-cent magnifiers bought in the dime store. If you wish, you can use only one lens, but the picture on the screen will be smaller and not so brilliant. If you have any other projection lens (from a magic lantern or standard movie projector), by all means use it.

The lenses are glued into a cardboard tube, which slides smoothly inside of another tube attached to the front of the board in which the slide carrier rotates. You will, of course, have to adjust their exact position when you are ready to start the show, so as to focus the star images sharply in the screen.

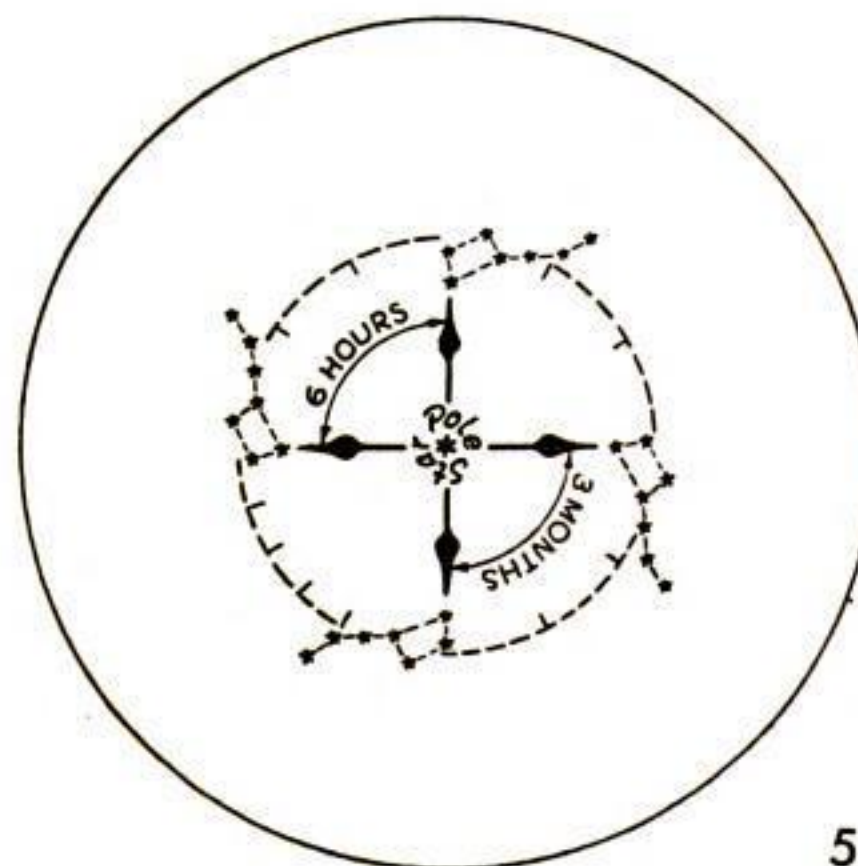
In giving your lecture, remember that the stars on the



screen must travel from right to left (counterclockwise) for slides showing the polestar and northern stars. With slides showing constellations in the zodiac, the stars on the screen must travel from left to right (clockwise). The star field, of course, travels east to west in both cases. The difference comes from the fact that the spectator views it looking north in one case and south in the other.

The writer has used the most ordinary, makeshift materials in order to demonstrate the ease of building a home planetarium which will duplicate some of the big instrument's effects. However, if you have a turning lathe, and are used to working with metal, you can produce a much more finished job. Another possibility is to use an old magic lantern or toy movie projector as the basis for your planetarium. You may find it easier to alter such a machine so it will take the revolving slide holder than to build the complete projector yourself.

When you have completed the construction of the projector and have made the slides, you are ready to entertain your friends with a realistic pageant of star movements. Of course, unless they, too, are amateur stargazers, they will be unfamiliar with the different constellations, and you will have to explain each slide to them as you show it. It is a (Continued on page 139)



Homemade Planetarium

(Continued from page 138)

good idea to prepare a little lecture like this, beginning it when you have placed slide No. 1 in position:

"Here, ladies and gentlemen, is the night sky on a clear, starlit evening (Start turning crank very slowly). The stars of the zodiacal constellations are traveling from east to west; new stars rise as others set.

"But now the night is over and the day is at hand. You see the dawn coming up in the east. It brightens, and here, peeping over the horizon, is the sun. The stars all fade out while it crosses the sky and finally sets in the west. Then the stars begin to appear again, and with them comes a crescent moon, which, in its turn, follows the sun over the horizon, leaving the stars to light the night again. (Change to slide No. 2).

"IF YOU were unable to recognize any of the 'star actors' in the previous act of our little drama of the sky, this slide will enable you to do so (Turn crank slowly). Here you see the daily and yearly processions of the zodiacal constellations across the southern sky. Since the zodiac is the sun's path, you were unable, in the previous slide, to see the constellations nearest to the solar disk, but here the sun is absent, so we view all the groups of stars in rotation. The month abbreviations at the top of the screen show when the constellations underneath them are directly south (on the meridian) at midnight. (Change to Slide 3 and frame picture

with polestar halfway up the sky. Start turning crank slowly).

"Here you see the northern constellations revolving around the polestar. They do so because the earth's axis points to it. In our latitude, about forty degrees north, the polestar is about halfway from horizon to zenith. But now let us get on the airplane of our imagination, travel to the north pole, and see what happens (Start sliding mask downward very slowly, still turning crank). As we go further north, the polestar rises higher and higher until, at the pole, it is right overhead.

"Now let us return to the equator (Start sliding mask upward, still turning crank). The polestar sinks toward the horizon as we go southward, until, at the equator, it rests directly upon it. (Change to Slide No. 4).

"YOU are now starting upon the 25,000-mile, round-trip journey which the polar axis of the earth makes among the stars. The present polestar no longer is the nearest to the earth's axis. The axis finally points to Vega. That bright star will be polestar in 13,000 A. D. and will be succeeded by others, until Alpha Draconis will again occupy the position of honor that it did in 2800 B. C., when the great pyramid of Egypt was being so constructed that this star would shine down one of its passages. (Change to Slide No. 5).

"As I rotate this slide slowly, you can see that the line from the Big Dipper to the polestar really is the hand of a great twenty-four-hour star clock. Each quarter of its circuit is completed in six hours. But you see that the Dipper also is a calendar, for, in addition, it revolves very slowly once every year."

Shock Absorber Added to Dog's Leash

A RUBBER band about $\frac{5}{8}$ in. wide cut from an inner tube makes an effective shock absorber for a dog's leash. The rubber is looped or knotted around the handle of the leash, and the hand is slipped through the elastic band.

If the leash is of the chain type, an automobile tire-chain spreader spring can be inserted between the links. In action, this reduces the effect of sudden jars.—ARTHUR AUSLANDER.

Finding Small Metal Parts Lost on Shop Floor

IN REPAIRING a gun lock, I accidentally let it fly apart, and four small pieces were thrown clear across the shop. To find them, I first tried sliding a magnet all over the floor. When this failed, I swept the floor and put the sweepings in a tub of water. The shavings and sawdust floated, and the metal parts sank to the bottom where they were quickly recovered.—J. J. EDWARDS.

Fine Lead Shot Adds Weight to a Model Locomotive

ADDING weight to a model locomotive can easily be done by mixing fine lead shot with liquid glue. Turn the locomotive upside down and pour this mixture in the boiler, then allow it to dry. Many locomotives are unbalanced, having more weight on the front drivers than in the rear, and when weight is added, it should be placed so as to equalize the weight on the driving wheels.



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Trapping Wild Horses

(Continued from page 39)

above the hoof, and the other around the horse's body at the flank, or to his tail. They pull this rope tight enough to keep the horse from running or trotting, but not so tight as to prevent him from walking. Then they turn him out.

He starts to run. Down he falls. He gets up and tries again. By the time he has thrown himself half a dozen times, he has learned wisdom and is content to walk.

At the end of a day of walking with that hobble, his forefoot is so sore from the rope that he is willing to behave. The second day, the mustanger throws him again and removes the hobble. Now he runs with the rest of the bunch, never making any attempt to leave. Inside a week, he's ready for shipment.

UP NEAR the top of a rocky plateau we found Baldy Waters's camp. Underneath a cedar stood a dried-out old wagon, a white canvas sheet thrown carelessly over one end of it. Covered by this sheet was the grub supply: a boxful of rice, a bag of salt, a small sack of flour, a half can of coffee—and the hind quarter of a yearling colt with the hoof still on!

We learned from the horse hunters that they were planning to "take" several traps that night. Corrals had been built at the water holes some time before, the mustangs had become accustomed to them, and nothing remained but to close the gates when the wild horses came in for their midnight drink. Wright and I were assigned to a trap at a hole called "Little Tank."

After supper we set out. It was dark, and I was glad that my companion belonged on this desert. How he ever found the place I'll never know, but inside half an hour, he told me: "Here we are. We'll leave our horses here. Then we'd better look at the gate, to make sure it's O. K."

We prowled around in the darkness, found the gate satisfactory, and then discovered the water hole—a small pool of brackish water, which felt hot to my hand.

We sat in the blind with our heads pulled down, because those mustangs can see as well in the dark as a cat. A desert wind blew up, and it turned cold. We shivered and dozed.

Suddenly Wright grasped my arm. "Hear that?" he whispered. I listened, straining my ears to catch the faintest sound. Yes; there was the far-off noise of pounding hoofs.

HE TESTED the wind, cautiously raising a moistened finger a few inches above the top of the blind.

"We're sure lucky," he announced. "They won't get wind of us, the direction they're coming. Now all we have to do is lie low."

We waited as they came closer. We dared not talk. Presently the sound of the herd stopped, which meant that the old stallion was making a survey of things, getting the lay of the land.

At last they were coming in! Assured that everything was well, the stallion had, in that mysterious language by which animals communicate with one another, given the signal to advance.

They were coming closer. We could hear an occasional squeal, as a quarrelsome old mare would protest to her companions. We (Continued on page 141)

PLASTICS

FOR SCHOOLS AND HOBBY CRAFTSMEN



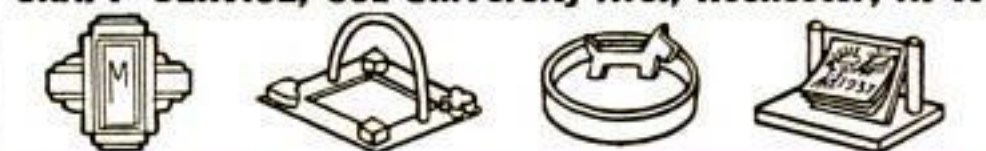
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Trapping Wild Horses

(Continued from page 140)

could see nothing, of course, in the darkness. Now we could hear them breathe, and the dust they raised was wafted in on us, and the horse smell was in our nostrils. They were in!

My companion touched my arm, pulled my ear over to his mouth, and said: "It won't be long. We'll dash on down in a minute. Don't forget to holler like the devil!"

A second later he shouted: "Let's go!"

My legs felt like rubber, and I followed him, as he led unerringly to the gate.

"Hi-i-yah! Whoop-ee!" he shouted.

I tried to shout, too. All I heard, above the din of snort and pounding hoofs, was a faint squeak.

WE CLOSED the gate.

"That's that!" he cried, exultingly. "We got 'em!"

"How many?"

"I judge twenty, twenty-five."

"And they're ours?"

"There's no way in the world now that they can get out," he said. "But I tell you what: Let's chase them into the catch corral; the sides are higher there. Come on."

He went into the trap and I followed him. Horses were everywhere. They dashed all around us. I thought every minute we'd be trampled to death.

"Say, we'll be killed!" I shouted.

"Not a chance. They're just as much afraid of us as we are of them—and besides, they can see better."

I felt horses brush up against me, felt their hot breath on my face. It was a terrifying experience, that of being afoot in the middle of a band of wild horses.

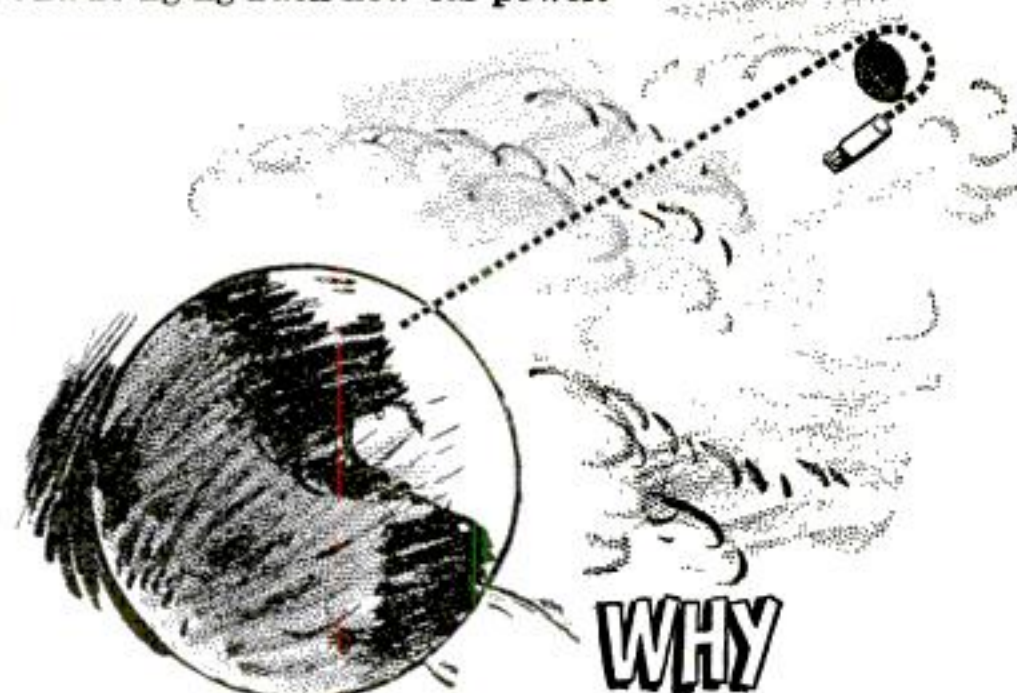
Gradually we worked them up into the end, and closed the second gate. Now we knew they were safe. All that remained was to go back to camp and, when daylight came, ride back with the wranglers. Within a week or two our wild captives would be broken to the will of man, and ready to pull harrows on tenant farms in the far-away cotton country.

New Artificial Fingers Hooked to Arm Muscles

ARTIFICIAL fingers that work almost like real ones were demonstrated recently by a German scientist. After a patient's hand has been amputated, holes are made in the ends of muscles that remain in the arms, and these holes are lined with living skin tissue. Small pegs of ivory or other material fit in the holes, and are connected to the fingers of the artificial hand by wires or strings. The hand usually is made with a pivoted thumb, and with the four remaining fingers moving as a single block. By contracting and relaxing the arm muscles, the wearer soon learns to move the thumb and fingers to perform tasks. Some patients, who have lost both hands, now are able to dress themselves, handle telephone switchboards, and perform other difficult operations. One man, who had two such artificial hands, was able to empty a box of matches on the table, pick up a small pair of forceps, and use this tool to put the matches, one by one, back in the box.



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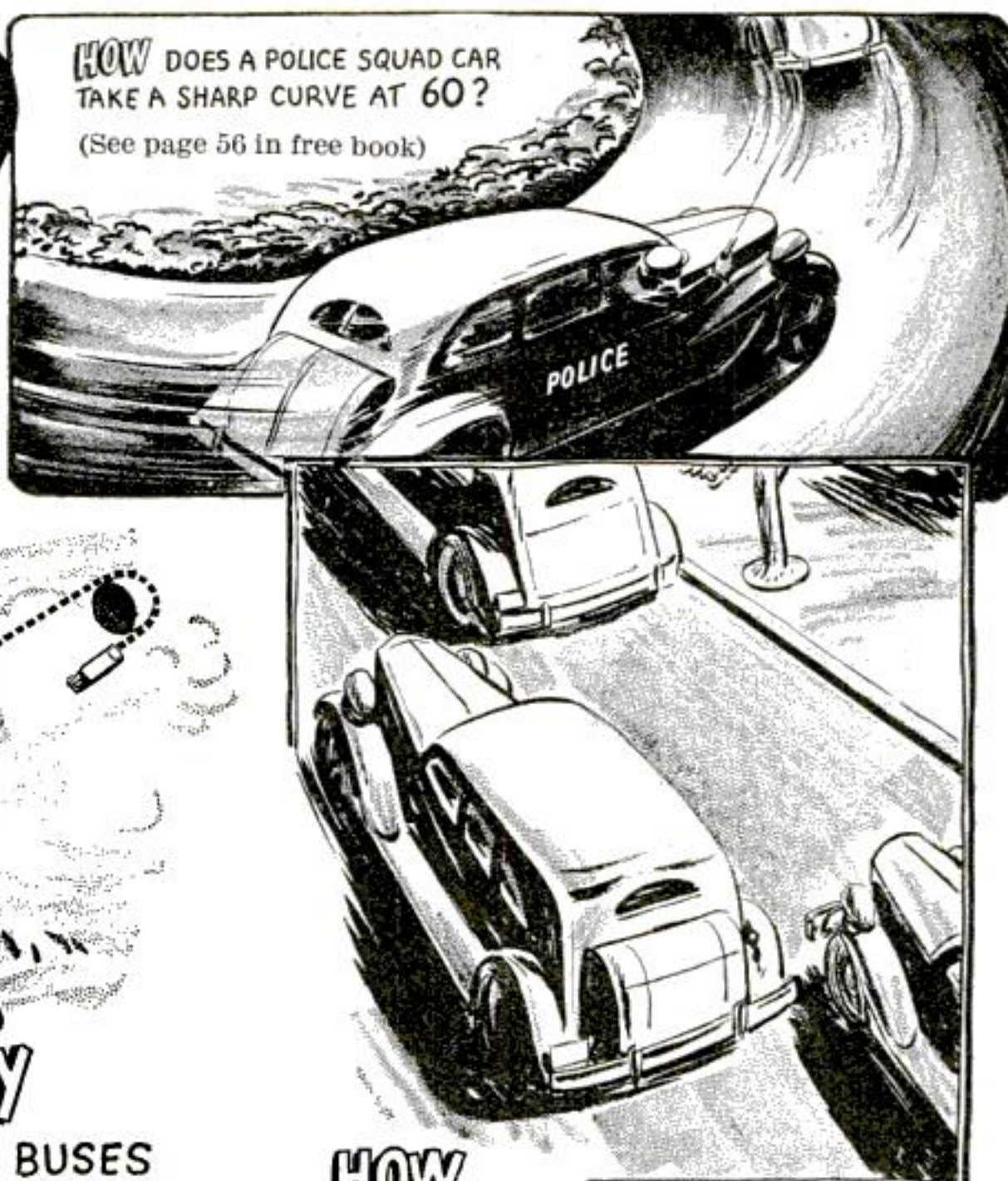
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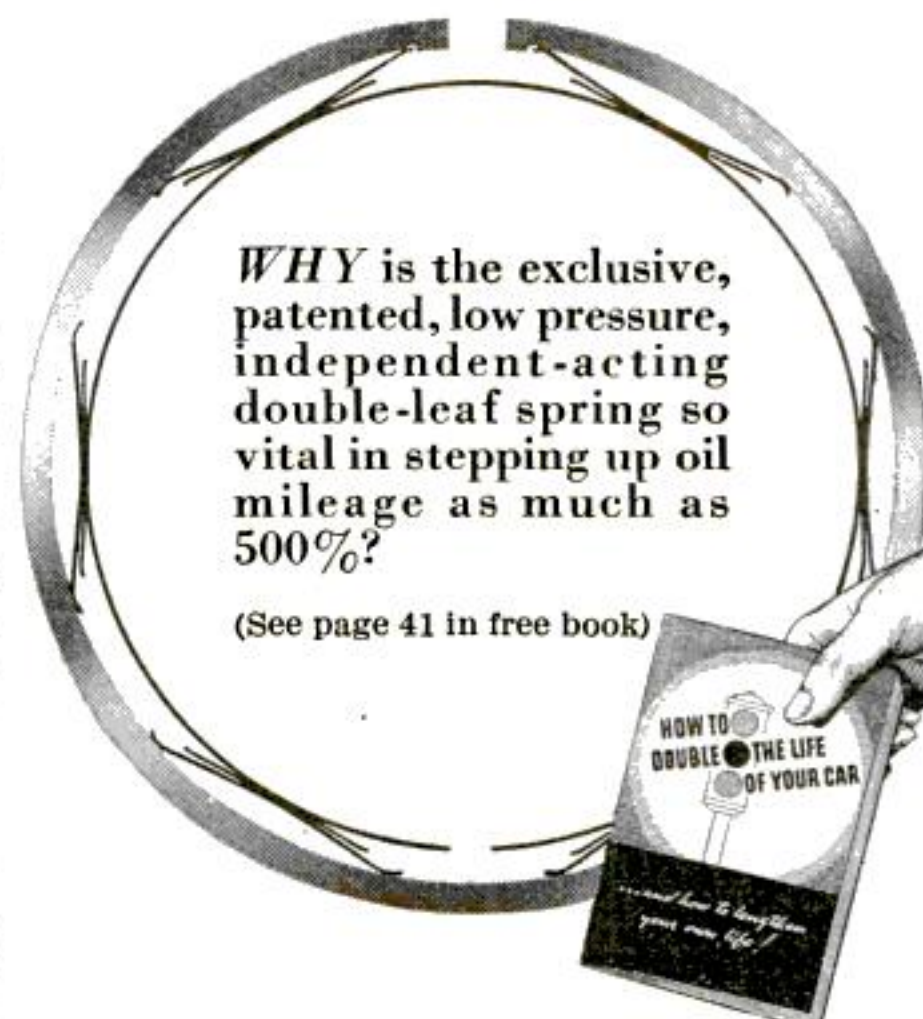


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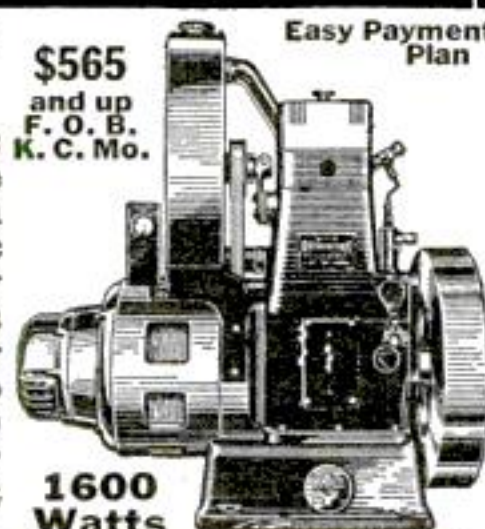
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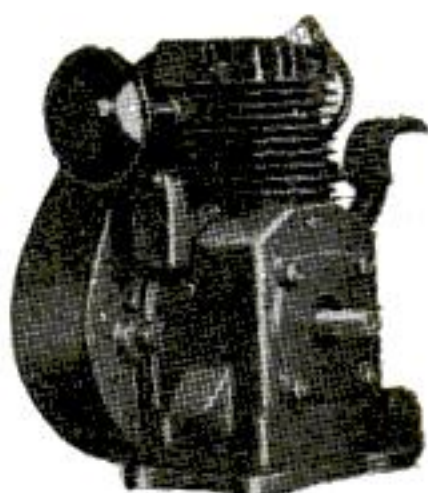
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Are You a Good Detective?

(Continued from page 58)

room where the proprietor was sleeping, and stabbed him to death. The victim was alone in the building at the time. No one heard any outcry, and the slaying seemed a case without a clew until a scientific sleuth discovered something on the floor of the bedroom. It was a bit of wax from the ear of the unknown killer. Examination showed that it contained wheat flour, which indicated that the man worked in a mill or bakery. With this clew as a start, the detective tracked down the slayer who had committed the murder as the climax of a quarrel over money matters.

BE CAREFUL, if you find yourself at the scene of a crime, not to disturb fragments of glass. They, like fingerprints, blood spots, and the imprint of a criminal's teeth, may provide essential clews. By examining a bullet hole in a window, for example, you can tell from which side of the pane the gun was fired. The side where the bullet enters the glass shows a round, comparatively clean hole; the side where it leaves the glass shows a craterlike depression where flakes of glass have been knocked away. If the bullet strikes the pane at an angle, more flakes are removed on the side toward which the missile is traveling. After such evidence as this makes it possible for detectives to reconstruct the train of events preceding a murder.

By fitting fragments of shattered glass objects together, you sometimes can bring to light facts that have an important bearing on the solution of a crime. The most remarkable instance of this kind of which I heard occurred in a New England city.

At the scene of a murder, a detective found a broken wineglass and evidence showed that the killer, who had fired five .32 caliber bullets into the body of his victim, was bleeding when he made his escape. The sleuth quickly put in calls to all doctors in the neighborhood. One reported he had removed a curving bit of glass from an injured man's hand a short time before. He still had the glass fragment in his office. The detective obtained it, fitted the pieces of the broken glass together like a jig-saw puzzle, and found that the fragment from the physician's office had come from the rim of the wineglass. The doctor was able to identify the patient. In his confession, the latter explained that during the violent quarrel which preceded the killing, the victim had hurled a wineglass, which shattered as it struck his hand.

IN HALF a dozen countries, researches have been carried on to aid detectives in obtaining clews from footprints. From the tracks of an unknown person, you can learn a surprising number of things. For example, if he is lame, the length of his stride will vary regularly; if he is excessively fat, he will keep his feet well apart to maintain his balance; if he is unfamiliar with his surroundings, he will trip over stones and bushes; if he is walking backward to throw pursuers off the track, the imprints left by the heels will be unusually deep.

When walking slowly, the average person takes a step of about twenty-seven inches. If he (Continued on page 143)

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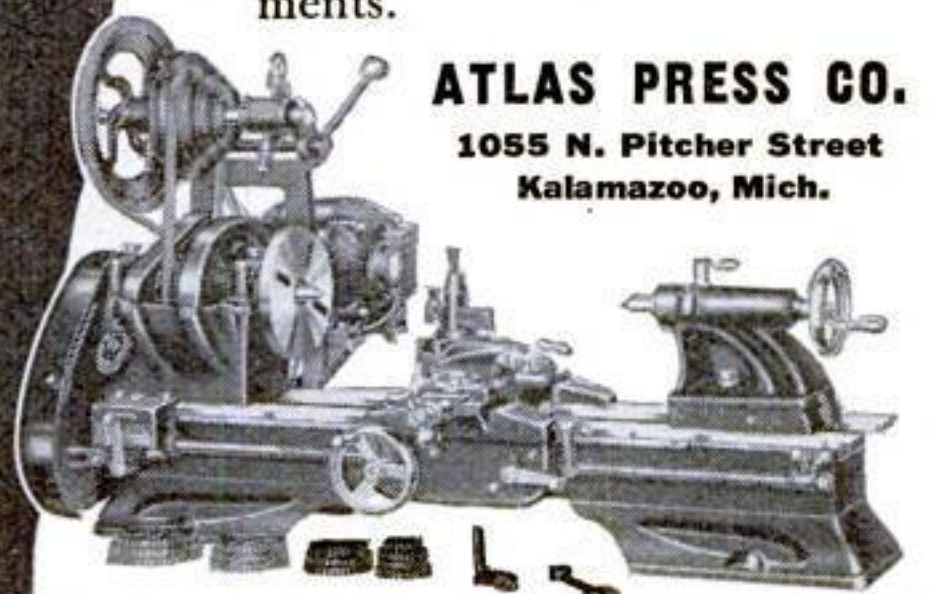


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Are You a Good Detective?

(Continued from Page 142)

is walking rapidly, his stride increases to about thirty-five inches. When he is running, it is forty inches or more in length. Most people, thousands of tests have shown, put the greatest pressure on the outer edge of the sole. If a footprint reveals that the reverse is true, you have a bit of evidence which immediately narrows down the search. Thus, footprints often form a major source of clues. In aiding in the solution of a crime, take special care to preserve all the ground-marks of the criminal.

A CLASSIC example of what *not* to do was recently reported from upstate New York. Shortly before midnight, a young man and a girl were driving down a deserted road when they heard another machine roar up from behind. A dark roadster cut in front of them and two men, revolvers in hand, leaped out. During the resulting stick-up, the young man was shot through the chest and mortally wounded. His plucky companion pulled him into the car, stepped on the accelerator, and sped away while the bandits emptied their guns after the fleeing car.

Before detectives could examine the scene thoroughly, people living in the neighborhood had swarmed over the road, obliterating the footprints of the murderers and picking up the empty cartridges to save as souvenirs. It was days before the police could recover all these mementos. Then, they proved a direct clue to the killers. They had been fired by a military-type revolver, only a few of which were known to be in the community. Tracing these weapons led to the capture and conviction of the bandits.

So, the first rule for the amateur sleuth is: Disturb nothing. The second rule is: Keep your eyes open. If you use your intelligence and know what to look for, you can recognize and preserve evidence which will play an important part in solving crimes.

How Good Are Your Powers of Observation?

(Answers to clew pictures on page 58)

A. The fact that the spots are elongated shows that the criminal was running. The splash marks to the right of the drops indicate he was moving in that direction.

B. The spots at the right were made by drops falling much farther than those at the left. This is shown by the longer splash marks around their edges. This indicates that the criminal was climbing the ladder.

C. The criminal was walking backward as indicated by the unusually deep heel print.

D. The owner of the hat is left-handed. Note the smudge of dirt on left side of brim, where he has held it in removing it and placing it on his head.

E. The suspect also is left-handed, as is shown by the fact that the matches have all been torn from the pack from the left side.

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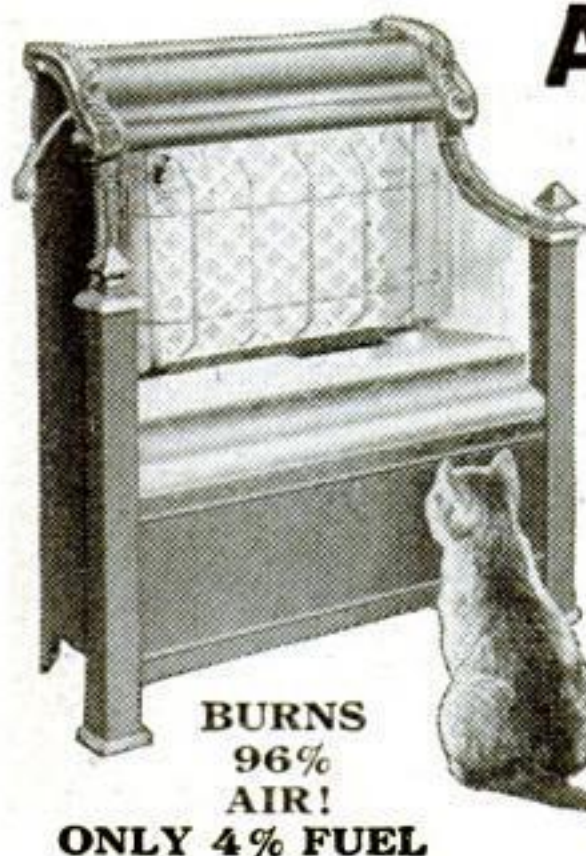
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Firefly Chemistry

(Continued from page 81)

serpents, and other symbols, and letting the luminous mixture of the solutions trickle down the cloth.

If you can obtain a glass coil or worm, such as is used in some types of laboratory condensers, you can produce a beautiful spiral column of glowing light—a sort of "witch's lamp"—by allowing the luminol mixture to drip through it. The source of the liquid will be invisible in the dark if you keep the two solutions apart, in a pair of separatory funnels which release them drop by drop, and let them mix just as they enter the glass coil.

A FOUNTAIN of light that will make a gorgeous display of radiance can be constructed from a pair of gallon jugs. Fill one of the jugs with the glowing luminol mixture and let the fluid siphon into the other jug, which is inverted and supported at a lower level. The lower jug is fitted with a two-hole cork carrying a medicine-dropper nozzle, through which the luminous fountain spurts upward within the vessel, and another glass tube for a drain. The height of the resulting fountain depends upon the difference in level between the two jugs. A screw-type pinch clamp on the rubber tubing connecting the jugs will help to regulate the flow and turn the fountain on and off.

For sure-fire results in chemical magic with luminol, use freshly made-up solutions and do not combine them until the moment arrives for your display. It is possible, however, to keep the separate solutions as long as several days, the one containing the hydrogen peroxide being the first to go stale by losing some of its oxygen.

Chemists do not fully understand the strange phenomenon of cold light. Oxygen evidently plays an important part in it, however. Omit the hydrogen peroxide from the mixture of chemicals used in the luminol experiments, and you will get no light.

Suppose you try to supply oxygen in some other way—by blowing your breath, for instance, through a solution containing only luminol, alkali, and potassium ferricyanide. Still you get no glow. Does it take oxygen in the peculiar nascent or active form that hydrogen peroxide liberates, to make luminol glow? You can readily find out. Decomposing water with electric current will also liberate nascent oxygen, and you can show that this will enable you to dispense with the hydrogen peroxide.

FOR this interesting experiment, dissolve a bit of luminol in water that has been made alkaline with a fragment of sodium hydroxide or potassium hydroxide. Also stir in a small crystal of potassium ferricyanide. Then pass a current of electricity through the solution. The source of the electric current may be three dry cells wired in series, or so that the electric circuit passes through each in turn. Connect the positive (center) terminal of the combination to a copper wire bent into the shape of a star, and the negative (outer) terminal to a carbon rod. When the star and the rod are immersed a short distance apart in the liquid, to serve as electrodes, current passes through the solution. Darken the room and you will see the wire star glowing with a soft blue light. Evidently the new-born (Continued on page 145)

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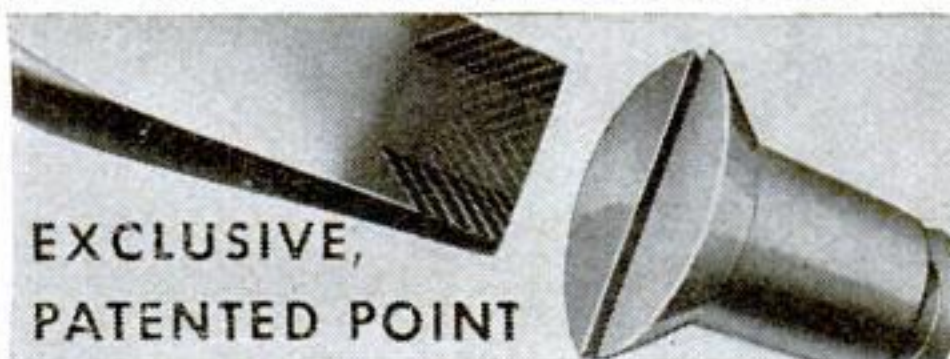
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Firefly Chemistry

(Continued from page 144)

oxygen liberated at this electrode makes up for the absence of any hydrogen peroxide in the solution. To observe the glow best, arrange the electrodes with the star on the side nearest you, since the action of the electric current gradually darkens the liquid and dims the light.

A mayonnaise jar with the top cut off makes a neat electrolytic cell, or receptacle for treating liquids with electric current, in experiments like the one just described. You will be surprised to find how cleanly you can remove the tops of these jars with the aid of an easily made electric bottle cutter. It will also cut glass tubing of any diameter larger than half an inch, and bottles of all shapes and sizes. This handy device consists of a length of nichrome wire to which ordinary house current is supplied through a pair of electric heating elements. The latter are connected in parallel.

TO CUT a jar or bottle, file a mark around the entire circumference where the break is to be made. Then plug the cord of the electric bottle cutter into an outlet, and hold the scratched mark on the glass against the red-hot nichrome wire, turning the jar or bottle constantly. Presently a crack will start. Continue rotating the glass vessel, however, until the crack has traveled all the way around it. Then the halves will fall apart of their own accord, or can easily be drawn apart. Emery cloth or an abrasive stone will smooth and round the sharp edge. By using a large enough loop of nichrome wire, even gallon jugs may be cut in two.

When a dye called fluorescein is used instead of luminol, the fountain-of-light apparatus will yield another spectacular lighting effect. Unlike luminol and other substances that glow of their own accord, fluorescein produces light of its own only when it is illuminated. Dissolve the merest pinch of the dye in water, together with a bit of alkali—say, sodium hydroxide or lye. The liquid glows or fluoresces when light strikes it—particularly ultra-violet light—and the yellow solution turns a queer, bluish color. An argon bulb, obtainable from any dealer in electrical supplies, makes a good source of ultra-violet rays for this purpose. As a matter of fact, an ordinary ten-watt lamp can be used, but the visible light that it gives off will make the effect much less spectacular. If you let the alkaline solution of fluorescein run through your fountain, and suspend the argon lamp just above the lower jug, you will obtain a beautiful display.

Charcoal-Driven Cars Are Popular in China

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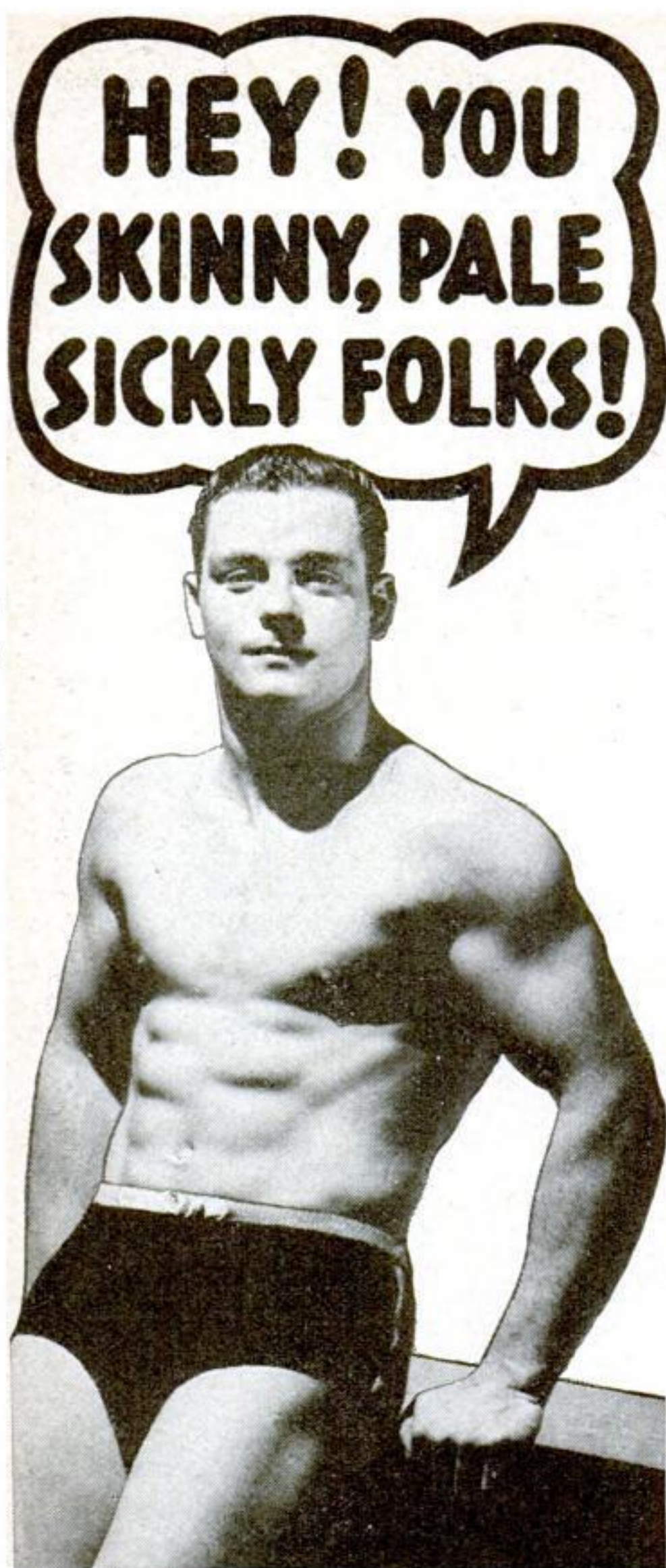
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Snake Hunter Catches Rattlers for Fun

(Continued from page 55)

between his feet. Miller jumped aside, picked the snake up on a hook, put him back in his original position, and calmly proceeded to repeat the stunt.

Several times Miller and his assistants have received liberal doses of venom on their arms and clothing, while escaping the needlelike fangs. Although an uncoiled rattler can strike only three or four inches, it can shoot venom out four or five feet.

ONE discovery led Miller to another as he became better acquainted with the desert reptiles. He came across a western diamond-back near Yuma, Ariz. Setting his shutter at a thousandth of a second, he took a position beside the snake, while a helper teased it into several strikes. When I viewed photographs of this scene, I noted that the snake's mouth was open so widely that the upper and lower jaws were in a straight line.

Despite the great speed with which the picture was exposed, the rattler's head moved too fast for a clear image, thus revealing the almost incredible swiftness with which these creatures strike.

On viewing the pictures under an enlarging glass, Miller suspected that he could dimly see the front fangs projecting straight forward, as though to lance directly into the handkerchief at which the snake was aiming. Several days later, to test the fang action, he caused several rattlers to strike into blobs of putty stuck against boards. In each case, he found, the fangs swung forward as on a pendulum and entered straight, as a physician pierces the skin with a hypodermic needle.

Another interesting fact was revealed as he observed rattlers killing their food. In each instance, the snake would strike, and then await the effects of the venom.

While traveling through a section of Arizona infested with gophers, Miller loosed a green prairie rattler, hoping to see it make a kill. The snake crawled to four gopher holes and looked in. At the fifth he stopped, coiled, and waited. Instead of coiling as he would for an immediate strike, the rattler kept his head low, behind the bulwark erected by his body. Soon a gopher emerged. At that instant, the snake struck, with such force that the little rodent was bowled over several times. The snake crawled up beside the gopher, and when the victim died a half minute later, the reptile licked the fur with its tongue. "That is a rattler's method of learning whether any life remains," the snake hunter explained.

MILLER carried only light equipment while searching for snakes—a few small boxes, several burlap sacks, forked sticks with which to pin the snake's head to the ground, and two sticks fitted with metal hooks on which to pick up specimens.

Hunting commenced shortly after sunrise, when the reptiles emerged from their hiding places to warm themselves. Occasionally Miller picked up large rattlers by the light of his headlights on lonely desert roads.

Through Miller's many hunts, he sought to unravel the mystery of the rattler's poison. "How is it delivered, and what is its effects?" he asked him-

self. In some snakes he found seven sets of fangs. These are partially hollow and taper to a needle point. The curve toward the rear of the mouth, being projected forward in striking.

The tip of the fang is solid, as is the under half of the upper portion. This gives it the necessary strength. Possibly a sixteenth of an inch above the solid tip, as shown by photographs which Miller took, is a needle-eye opening through which venom is ejected. A vertical groove from the opening, leading down toward the point, conveys the poison fluid. When one is bitten by a rattler, the venom causes a rapid coagulation of the blood; the heart, unable to pass the curded substance, ceases to function.

"THE rattler's venom sacs," Miller explained, "are located on the upper and outer curvature of the skull structure at the rear where the head widens. One can cause the venom to be exuded by pressing on this portion of the head.

"Without some means to eject the venom, rattlers apparently poison themselves. For that reason, only 'hot' snakes, or those containing fangs, are used in shows."

But the effect of venom on human blood! How could that be determined? Obviously, Miller could not practice on live subjects, but he carried rattlers by the score to his laboratory, extracted their poison, and mixed it with fresh blood specimens. From 200 neighbors in Hollywood he secured blood specimens, and in thirty-two cases the venom showed no coagulation effects. In all others, the blood became a sticky mass within a few seconds after the venom was brought in contact with it.

Interested by these results, Miller went further. With 382 rattlers in his cages, he again milked venom from their fangs, placed it on slides, and allowed it to crystallize. Taking tiny pinches of the powdery substance, he injected several doses, about one fiftieth of the amount a rattler ordinarily would eject, into the blood streams of rats. In every case, the little rodents died within one minute. Such is the potency of a rattler's venom!

Miller found that rattlers do not thrive in captivity unless their cages are provided with floors of sand on which they can scrape off the fungus which grows on the under side of their bodies. Too, in many instances he found it necessary to give them aid in shedding their skins. Grasping a snake by the neck, he would plunge it into a basin of water and work the softened skin down its back and over its tail.

BY OBSERVING the rattlers closely in captivity, he learned that a new rattle is added each time a snake sheds, and not necessarily once a year as most people believe. Some shed four times yearly. Thus, six rattles may indicate an age of eighteen months, or of three years. You can't be sure of a snake's age from this evidence alone.

Having virtually lived with venomous reptiles for nearly a half year on various occasions, Miller now plans to return to the desert, there to seek out other little-known facts about these desert killers.



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Quit Stalling!

(Continued from page 86)

motor won't start under such conditions, and even if it does, the wettest plugs are likely to miss a lot till the motor warms up enough to dry off the moisture."

"Anything the matter with that float?" Devon asked, as Gus removed it from the carburetor and shook it gently.

"Tight as a drum," Gus replied. "If any gas had leaked into it, you could hear it slopping around when you shake it. There doesn't seem to be much dirt in the carburetor either, so I guess we'd better have a look at that fuel pump."

GUS disconnected the gas pipe between the fuel pump and the carburetor, and connected the former with the gauge on the testing stand. Then he started the motor, which could be run for a brief time on the gasoline remaining in the carburetor float chamber. The gauge showed that the pressure developed by the pump was considerably higher than it was supposed to be.

"Now, here is what happens," Gus explained. "So long as no dirt gets under this needle valve that is operated by the rising and falling of the float, everything is fine, because the extra pressure is not nearly enough to force the needle open against the closing pressure produced by the float. But the minute the tiniest speck of dirt lodges under the needle, the gas keeps on flowing after the gasoline level in the float chamber has reached its proper height."

"Of course, the speed of this excess flow," Gus went on, "depends on how big the speck of dirt is, as well as on the pressure of gasoline. And you've got to remember that the motor, even when it's idling, uses gas steadily. If the fuel-pump pressure is normal, a tiny piece of dirt under the needle will not cause gas to flow faster than it is burned by the engine, so no harm is done."

"Now I get it," Devon interrupted. "If the pump pressure is high, a lot more gas is forced through, the carburetor is flooded, and the motor stops from having too rich a mixture. So when I let the motor stand while I cleaned the plugs the first time it stalled, and while I tried to find a loose wire the second time, the excess gas cleared away and the motor started. And I was blaming the ignition all the time!"

GUS smiled. "Anybody could make that mistake. The funny part of it is that you probably could have started the motor right away either time just by opening the dash control of the throttle and holding it that way for a few seconds before you stepped on the starter, instead of giving the throttle pedal a quick jab like most people do at the instant when they step on the starter."

"When you jab the pedal," Gus explained, "this plunger shoots raw gas into the manifold—which is just what you don't want, because there's too much gas already."

"So what I should remember," Devon summed up, "is that the next time the motor stops like that, I should get it started with the dash-control throttle—and, of course, not use the choke. Is that right?"

"Correct—if the dirt that's causing the trouble happens to be under the float needle valve," Gus pointed out. "But if the motor stops when it's idling because dirt has partly (Continued on page 148)

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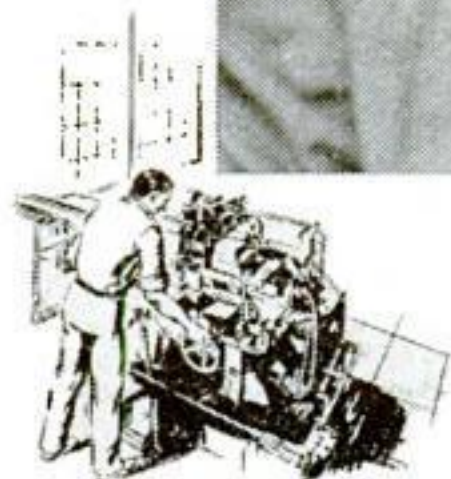
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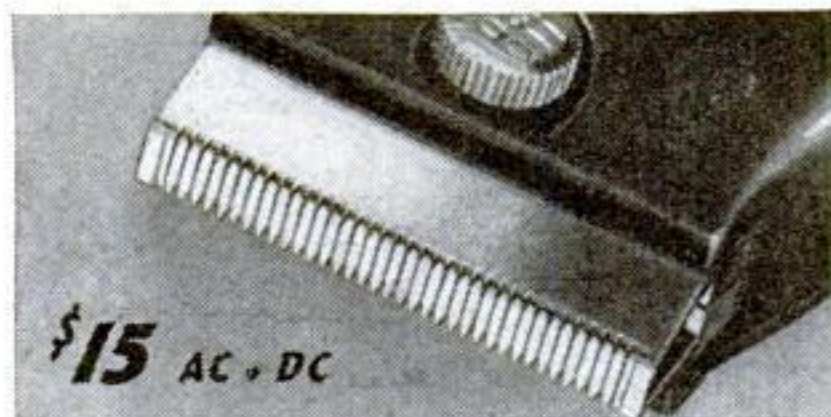
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Quit Stalling!

(Continued from page 147)

clogged the carburetor jets, then you're up against exactly the opposite situation. In that case, the motor dies from gas starvation, so pulling out the choke to get a thicker mixture in the cylinders will get you started. And, after the motor is idling pretty fast, you often can suck the dirt out of the clogged jet by yanking the choke all the way out for a half second or so while you step on the throttle. That trick also will cure 'stuttering' caused by water in the carburetor."

"That makes sense," Devon agreed, "but how do you know which trouble you're up against? Suppose she just stalls. How are you going to tell whether it's dirt under the float needle or dirt in the idler jet?"

"SINCE it usually happens in traffic," Gus replied, "and the first thing you notice is that the motor isn't running any more, the best thing to do is to treat the motor as if it were flooded—and if it doesn't start after a couple of attempts, then give it the works with the choke. Always try the remedies in that order, because if you go at it the other way around, you'll flood the motor worse than ever—if flooding happens to be the trouble."

"Of course," Gus added, "if the trouble is caused by a leaky float that lets the level of gasoline in the float chamber get too high, the way to get the motor going when it stalls from flooding is the same as for dirt under the float needle. But unless you have the float fixed at the first opportunity, it'll only be a question of time before enough gas gets inside the float to sink it, and then your goose will be cooked. The motor will choke up every time you start it, and you won't be able to keep the engine running at all except at racing speed."

"Seems to me," Devon recalled, "I had a leaky float on a car I owned several years ago, and while the motor ran pretty badly, stalled often, and used a whale of a lot of gasoline, I could still use it, and it certainly didn't stall every time I started the motor. Why shouldn't a modern car do at least as well?"

"Your old car," Gus explained, as he finished the job on the carburetor and fuel pump, "undoubtedly had a vacuum-tank fuel feed that probably was set pretty close to the level of the carburetor. Besides that, I doubt if the float could have been so filled with gasoline that it wouldn't float at all. Anyway, it wouldn't have worked that well with a modern pump-feed system if the pressure was higher than normal."

"COULDN'T the old vacuum tank produce extra pressure, too?" Devon asked.

"That was one of the faults it didn't have," Gus chuckled, "although it had plenty of others."

"With a vacuum tank, you know, there was no pressure-feed system like you have with a fuel pump. The gas just flowed down from the tank to the carburetor by its own weight."

"It's easy to see that when you get your pressure by letting gasoline flow down by gravity from one tank to another, the only way you could get higher pressure without moving the vacuum tank would be by changing the law of gravity—and even Einstein hasn't been able to do that!"

Death Waited...While I Dangled in the Dark

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William N. Taylor Survives Weird Accident



"I had rolled a big stump to the edge of the 350 foot cliff in front of my summer place at Lake Taneycomo," writes William N. Taylor, of 619 West 13th St., Kansas City, Mo. "As I gave it a final shove over the precipice, a



sharp spur of root caught my pants-leg, pulled me into the black void with it.

"For an instant I seemed suspended in the darkness. Then something hit me, knocked the wind out of me, but I grabbed just the same, found myself swinging like a pendulum from a branch of a gnarled old cedar that somehow had found a foothold in the cliff about 30 feet below the rim. Beneath my dangling soles was 300 feet of *nothing*!

"When I could get my breath, I called to my companion to cut the well-rope and lower an end to me. Quickly, he returned to the edge of the cliff, but it was none too soon. My hands were beginning to ache from the strain. Soon they would be numb from lack of blood. Then there would be a nauseating drop, and my troubles would be over.

"Where are you?' my friend was calling,

'I can't see a thing down there.' I answered him again and again. He cast the rope vainly into the dark...and then, in the most desperate, hopeless situation I ever hope to see...I thought of the flashlight in my hip pocket.

"There was nothing for it but to trust my

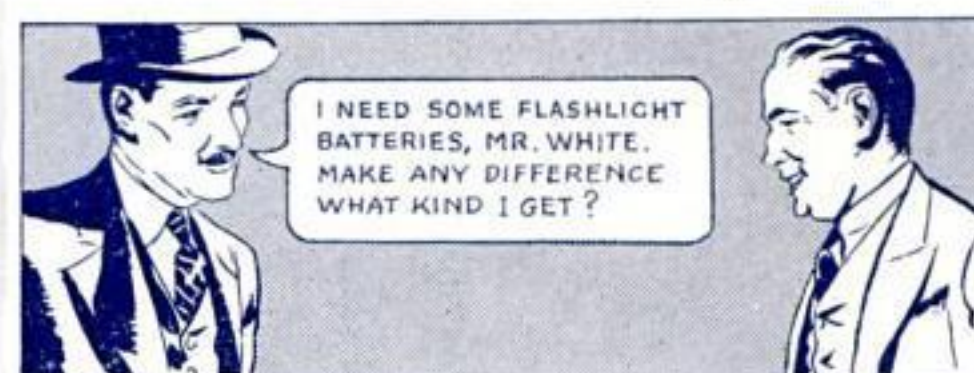


life to my good right hand, fish for the flashlight with my left, and pray there was still life in those batteries. The light worked, enabling my companion to reach me with the rope. Otherwise there would have been one more of those 'omit flowers' notices in the paper. Once more *fresh* DATED 'Eveready' batteries proved their dependability.

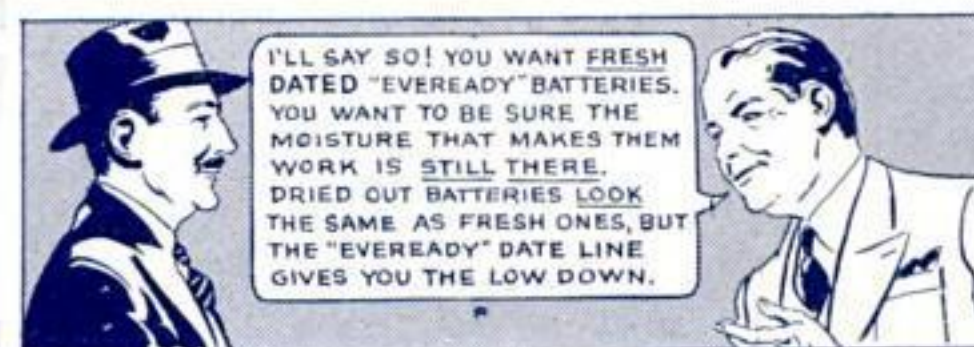
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